PROGRESS REPORT FOR UTAH'S STATE IMPLEMENTATION PLAN FOR REGIONAL HAZE

September 23, 2014

Prepared by staff of the:

Utah Division of Air Quality
Utah Department of Environmental Quality
195 N 1950 W
Salt Lake City, UT 84114

Table of Contents

Tables

Figures

1.0 INTRODUCTION

On December 12, 2003, the State of Utah submitted a Regional Haze State Implementation Plan (RH SIP) to meet the requirements of 40 CFR 51.309 (309 SIP) to improve visibility in Utah's five Federal Class I Areas. The 2003 version of the 309 SIP and subsequent revisions to it address the first phase of requirements, with an emphasis on stationary source sulfur dioxide (SO_2) emission reductions, smoke management, and a focus on improving visibility on the Colorado Plateau.

On December 14, 2012 the EPA approved the majority of Utah's RH SIP, but disapproved several SIP provisions, which included the BART determination for nitrogen oxide (NOx) and particulate matter (PM). Utah is in the process of preparing a revised SIP to address EPA's concerns, which will be addressed in a separate SIP submittal. The results of that analysis will be addressed in a separate SIP submittal. The 2008 BART determination has been fully implemented and significant emission reductions of NOx, SO_2, and PM have already been achieved.

1.1 State Implementation Plan Requirements for the 5-Year Progress Report

Provisions of the Regional Haze (RH) rule contained in 40 CFR §51.309(d)(10) require that each state submit a progress report five years after the submittal of their initial RH SIP. The progress report must be in the form of a SIP revision and must include a determination regarding the adequacy of the existing regional haze SIP. This report has been prepared to fulfill all applicable requirements pertaining to the five-year progress report of the initial RH SIP. In response to EPA's partial approval and disapproval (77 FR 74355 (December 14, 2014), the State of Utah is developing a revised SIP package.

The progress report SIP must include 1) the status for implementation of control measures included in the original regional haze SIP, 2) a summary of emission reductions achieved through the implementation of control measures, 3) an assessment of visibility conditions, 4) an analysis of the changes in emission pollutants, 5) an assessment of significant changes in emissions that may have limited or impeded progress in improving visibility, 6) an assessment of whether the current SIP elements and strategies are sufficient to meet reasonable progress goals and 7) a review of the State's visibility monitoring strategy.

The technical data included in this progress report are from the "*Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report"* (Appendix A) developed by the Western Regional Air Partnership (WRAP)[1] in June of 2013 and the WRAP Technical Support System (TSS). The WRAP progress report technical support document (TSD) has been prepared on behalf of the 15 western state members in the WRAP region. It serves as the technical basis for use by states to develop the first of their individual reasonable progress reports for the 116 Federal Class I areas located in the western states. Data are presented in this report on a regional, state, and Class I area-specific basis that characterize the difference between 2000-2004 baseline conditions and current conditions, represented here by the most recent successive 5-year average. The WRAP progress report TSD was focused on the first 5-year period, 2005-2009, and therefore the monitoring and emission inventory data reflect that time

[1] The WRAP is a collaborative effort of tribal governments, state governments and various federal agencies representing the western states that provides technical and policy tools for the western states and tribes to comply with the EPA's RH regulations. Detailed information regarding WRAP support of air quality management issues for western states is provided on the WRAP website, www.wrapair2.org. Data summary descriptions and tools specific to RHR support are available on the WRAP Technical Support System website, http://vista.cira.colostate.edu/tss/.

period. Changes in visibility impairment are characterized using aerosol measurements form the IMPROVE network (the primary monitoring network for regional haze, both nationwide and in Utah), and the differences between emissions inventory years represent both the baseline and current progress period.

As required by 40 CFR §51.308(i), the regional haze SIP must include procedures for continuing consultation between the states and federal land managers (FLMs) on the implementation of the visibility protection program, including development and review of implementation plan revisions and 5-year progress reports, and on the implementation of other programs having the potential to contribute to impairment of visibly in any mandatory Federal Class I area within the state. Utah intends to consult with federal land as required under 40 CFR §51.308. The state of Utah reaffirms its commitment to participate in a regional planning process with Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Oregon, South Dakota, Washington, Wyoming, the United States Department of Interior (USDI) Fish and Wildlife Services (FWS) and National Park Services (NPS), and the United States Department of agriculture (USDA) Forest Service (FS).

Pursuant to the Tribal Authority Rule, any tribe whose lands are within the boundaries of the State of Utah has the option to develop a RH Tribal Implementation Plan (TIP) for their lands to assure reasonable progress in the five Class I areas in Utah. Accordingly, no provisions of this periodic report shall be construed as being applicable to Indian Country.

2.0 UTAH CLASS I AREAS

Utah has five Federal Class I areas within its borders: Arches National Park, Bryce Canyon National Park, Canyonlands National Park, Capitol Reef National Park, and Zion National Park. All five of Utah's Federal Class I areas are located on the Colorado Plateau (Figure 2.1).

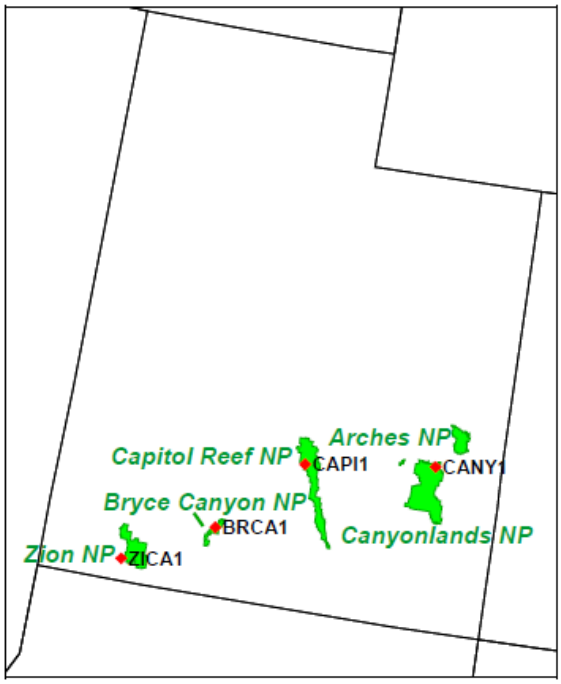

Figure 2.1. Map Depicting Federal Class I Areas and Representative IMPROVE Monitors in Utah

Utah's Department of Environmental Quality's (DEQ) Division of Air Quality (DAQ) is responsible for developing the RH progress report. This progress report compares the current visibility conditions at each of these Class I areas to the 2018 reasonable progress goals to determine if Utah is on track to reach these goals. The progress report also reviews the long-term strategy to determine if there have been any changes that need to be addressed.

In developing the initial RH SIP, DAQ also considered that emission sources outside of Utah may affect the visibility at Utah's Class I areas, and that emission sources within Utah may affect the visibility at Class I areas in neighboring states. Through WRAP, the western states worked together to assess state-by-state contributions to visibility impairment in specific Class I areas, including those in Utah and those affected by emissions from Utah. The sources identified in the initial RH SIP either impacting Utah's Class I areas or Class I areas outside Utah will be reviewed as part of this progress report.

2.1 Progress Towards Reasonable Progress Goals (40 CFR §51.309(d)(10(i))

Based on IMPROVE monitoring data, all of Utah's Class I areas show visibility improvement on the 20% least impaired days, while on the 20% most impaired days, three areas (Arches, Canyonlands and Zion National Parks) show visibility improvement and two areas (Bryce Canyon and Capitol Reef National Parks) do not. The largest contributor to increases at these sites was particulate organic mass which was associated with large fire events in July and August of 2009. These increases were offset by decreases in ammonium nitrate and ammonium sulfate.

The baseline and current visibility conditions as well as the reasonable progress goals for 2018 for the 20% worst and 20% best days are displayed in Table 2.1.

Table 2.1. Utah Class I Area IMPROVE Sites Visibility Conditions for the 20% Most and Least Impaired days – Including 2010 to 2012.

Class I Area	Baseline (2000-2004) (dv)	Current (2005-2009) (dv)	(2010-2012) (dv)	2018 Preliminary Reasonable Progress Case (PRP18a) (dv)
20% Worst Days				
Arches NP (CANY1)	11.2	11.0	10.6	10.9
Bryce Canyon NP (BRCA1)	11.6	11.9	10.0	11.2
Canyonlands NP (CANY1)	11.2	11.0	10.6	10.9
Capitol Reef NP (CAPI1)	10.9	11.3	10.1	10.5
Zion NP (ZICA1)	12.5[2]	12.3	10.8[3]	N/A[4]
20% Best Days				
Arches NP (CANY1)	3.7	2.8	2.8	3.5
Bryce Canyon NP (BRCA1)	2.8	2.1	1.7	2.6
Canyonlands NP (CANY1)	3.7	2.8	2.8	3.5
Capitol Reef NP (CAPI1)	4.1	2.7	2.4	3.9
Zion NP (ZICA1)	5.0	4.3	4.4 (see footnote 2)	N/A (see footnote 3)

3.0 REGIONAL HAZE PROGRESS REPORT

The requirements for regional haze progress reports are outlined in 51.309(d)(10)(i). The progress report for Section 309 RH SIPs must be in the form of a formal SIP submittal and at a minimum must contain the following elements:

3.1 40 CFR § 51.309(D)(10)(i) Progress Report Requirements

(A) A description of the status of implementation of all measures included in the SIP for achieving reasonable progress goals for mandatory Class I Federal areas both within and outside the state.

(B) A summary of the emission reductions achieved throughout the state through implementation of the measures described in (A) above.

(C) For each mandatory Class I Federal area within the state, an assessment of the following: the current visibility conditions for the most impaired and least impaired days; the difference between current visibility conditions for the most impaired and least impaired days and baseline visibility conditions; and the change in visibility impairment for the most impaired and least impaired days over the past 5 years.

[2] The monitor originally intended to represent Zion National Park was the ZION1 IMPROVE monitor, which began operation in 2000. In 2003, a second site, ZICA1, was established approximately 19 miles from the original ZION1 monitor. The second site was installed in part because elevated ammonium nitrate at the original site was influenced by mobile sources from the interstate highway that were not representative of park conditions. Section 6.13.1.1 in the WRAP Report (Appendix A) describes how the baseline for the ZICA1 was determined.

[3] Includes 2012 data only; there were no results available for 2011 and 2012

[4] There is no PRP18a established for the new ZICA1 monitor. The PRP18a was originally established for the original ZIONI IMPROVE monitor, which was discontinued on July 29, 2004.

(D) An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities with the state. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.

(E) An assessment of any significant changes in anthropogenic emissions within or outside the state that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility.

(F) An assessment of whether the current SIP elements and strategies are sufficient to enable the state, or other states with mandatory Federal Class I areas affected by emissions from the state, to meet all established reasonable progress goals.

(G) A review of the state's visibility monitoring strategy and any modifications to the strategy as necessary.

In the sections to follow, the Utah DAQ will address the various periodic review requirements as outlined above.

3.2 Status of Implementation Control Measures: 40 CFR §51.309(d)(10)(i)(A)

40 CFR §51.309(d)(10)(i)(A) requires "a description of the status of implementation of all measures included in the implementation plan for achieving reasonable progress goals for mandatory Class I Federal areas both within and outside the State."

This section provides a description of the emission reduction measures that were included in the State of Utah's Section 309 RH SIP. A summary of the most significant emission reduction strategies and the status of controls is provided below.

Utah has been and continues to be committed to implementing the long-term strategies adopted into the state's Section 309 RH SIP. The implementation status of these emission reduction measures are described below.

SO_2 Milestone and Backstop Trading Program

As a 309 state, Utah continues to participate in the Regional SO_2 Milestone and Backstop Trading Program. Utah has been participating in this program since 2003, and in March of 2014, submitted the annual Regional SO_2 Emissions and Milestone Report for 2012. The report shows that the regional SO_2 emissions of 115,115 tons were below the 2012 milestone of 200,722 tons. Further information on emissions reductions from this program are summarized in Section 3.3 of this report.

Prevention of Significant Deterioration (PSD); New Source Review (NSR) Permitting; and Visibility Programs

Utah's PSD program, promulgated in SIP Section VII and R307-405; NSR permitting program, promulgated in SIP Section II and R307-401; and Visibility program, promulgated in SIP Section XVII and R307-406 continue to protect Class I area visibility by requiring best available control technology for

new sources and assuring that there is not a significant degradation in visibility at Class I areas due to new or modified major sources.

BART

Utah has four BART-eligible sources that are subject to BART. They are PacifiCorp Hunter Units 1 and 2 and PacifiCorp Huntington Units 1 and 2.

Utah's 2008 BART determination for Hunter Units 1 and 2 included conversion of existing electrostatic precipitators to pulse jet fabric filter bag-houses; the replacement of existing, first generation low-NOx burners with Alstom TSF 2000TM low-NOx firing system and installation of two elevations of separated overfire air; and the upgrading of the existing flue gas desulfurization system to >90% sulfur dioxide removal. These controls were installed on Hunter Unit 2 in 2011 and Hunter Unit 1 in 2014. Average annual emissions decreased by 1,306 tons SO_2 and 3,028 tons NOx for these two units between 2001-3 and 2012-13.

For Huntington Units 1 and 2, the 2008 BART determination included converting existing electrostatic precipitators to pulse jet fabric filter bag-houses; the replacement of existing, first generation low-NOx firing system and installation of two elevations of separated overfire air; the installation of a new wet-lime, flue gas de-sulfurization system at Unit 2 (FGD); and upgrading existing flue gas desulfurization system to >90% sulfur dioxide removal at Unit 1. These controls were installed on Huntington Unit 1 in 2010 and Huntington Unit 2 in 2006. Average annual emissions decreased by 12,344 tons SO_2 and 4,324 tons NOx for these two units between 2001-3 and 2012-13.

EPA disapproved Utah's BART determination for NOx and PM on December 14, 2012, because they determined that Utah did not perform an adequate 5-factor analysis as required by 40 CFR Part 51, Appendix Y. Utah is preparing a separate SIP submittal to address EPA's concerns – concurrent with this progress report.

Enhanced Smoke Management Program

The State of Utah has developed *The Utah Smoke Management Plan (SMP)* which provides operating procedures for federal and state agencies that use prescribed fire, wildfire, and wildland fire on federal, state and private wildlands in Utah. The SMP includes the program elements listed in 40 CFR 51.309(d)(6)(i), with the exception of alternatives to fire. The SMP was certified by the EPA on November 8, 1999 under EPA's April 1998 *Interim Air Quality Policy on Wildland and Prescribed Fires (Policy).* The requirements of the SMP were also codified into Utah's Air Quality Rule R307-204, which applies to all persons using prescribed fire or wildland fire on land they own or manage, including federal, state, and private wildlands.

New Source Performance Standards Program

Utah's New Source Performance Standards (NSPS) rule, R307-210, incorporates the latest version of 40 CFR Part 60 into Utah's administrative rules. These technology based standards which apply to specific categories of stationary sources, result in significant emissions reductions – 40 CFR Part 60 Subpart JJJJ, Standards of Performance for Stationary Spark Ignition Internal Combustion Engines; and Subpart IIII,

Standards of performance for Stationary Compression Ignition Internal Combustion Engines, are just two examples.

Maximum Achievable Control Technology (MACT) Standards Program

Utah's administrative rule, R307-214, National Emission Standards for Hazardous Air Pollutants, incorporates the latest version of 40 CFR Parts 61 and 63 into Utah's Air Quality rules. NESHAPs are the result of MACT standards, performannce-based standards, EPA has developed specific to source categories. As with NSPS, these NESHAPS result in significant emissions reductions – 40 CFR Part 63 Subpart ZZZZ, Standards for Reciprocating Internal Combustion Engines, is just one example.

Mobile Sources

The adoption of new on-road vehicle emission and fuel standards by EPA resulted in a substantial reduction of projected mobile source emissions. As stated in Section F.2.b of the SIP, Utah is committed to monitoring the emissions from mobile sources to assure a continuous decline in emissions as defined in 40 CFR 51.309(b)(6). If Utah determines that a continuous decline in emissions is not being achieved, additional control measures will be reviewed to determine if they are needed to make reasonable progress.

Enforceability of Utah's Measures

40 CFR §51.309(d)(9) of the RH rule requires states to ensure that emission limitations and control measures used to meet reasonable progress goals are enforceable.

Utah has ensured that all existing emission limitations and control measures for which it is responsible that were used to meet reasonable progress goals are enforceable, either through Utah's Administrative Rules or SIP measures previously approved by the Utah Air Quality Board and the EPA. Enforceability of future emission limitations and control measures for which the State is responsible will be enforceable through permit conditions or SIP measures to be approved in the future by EPA. Utah is preparing a separate SIP submittal, concurrent with this progress report, to address the portions of the SIP that EPA disapproved because it did not contain the provisions necessary to make BART limits practically enforceable.

3.3 Summary of Emission Reduction Achieved: 40 CFR § 51.309(d)(10)(i)(B)

40 CFR § 51.309(d)(10)(i)(B) requires "a summary of the emissions reductions achieved throughout the State through implementation of the measures in paragraph (g)(1)."

This section provides a summary of emissions reduced as a result of implementation measures discussed in Section 3.2. Since the submittal of Utah's Section 309 SIP in 2003, there has been a significant decrease in SO_2 emissions in accordance with the state's SO_2 Milestone and Backstop Trading Program. Each year since 2003, states have been able to demonstrate through milestone reports that actual SO_2 emissions have declined every year and are well below the milestones. Sulfur dioxide emission reductions associated with the Backstop Trading Program will continue through 2018, as shown through declining milestone commitments. The actual emissions and their respective milestones are shown below:

Regional Sulfur Dioxide Emissions and Milestone Report Summary

Year	3-State Adjusted SO_2 Emissions (tons)	3-Year Average (tons)	Milestone (tons)
2003	214,780	214,780	303,264
2004	232,388	223,584	303,264
2005	215,793	220,987	303,264
2006	207,316	218,499	303,264
2007	187,599	203,569	303,264
2008	165,595	186,837	269,083
2009	143,704	165,633	234,903
2010	131,124	146,808	200,722
2011	117,976	130,935	200,722
2012	96,246	115,115	200,722

While Utah has not quantified the emissions reductions due to the remaining strategies, the state saw an overall improvement in visibility at all of Utah's Class I areas for the 20% best days and an overall improvement in visibility at three of Utah's Class I areas for the 20% worst days between 2000 and 2009 (See Figures 3.1 and 3.2). Changes in the overall emission inventory are described in section 3.5 of this report.

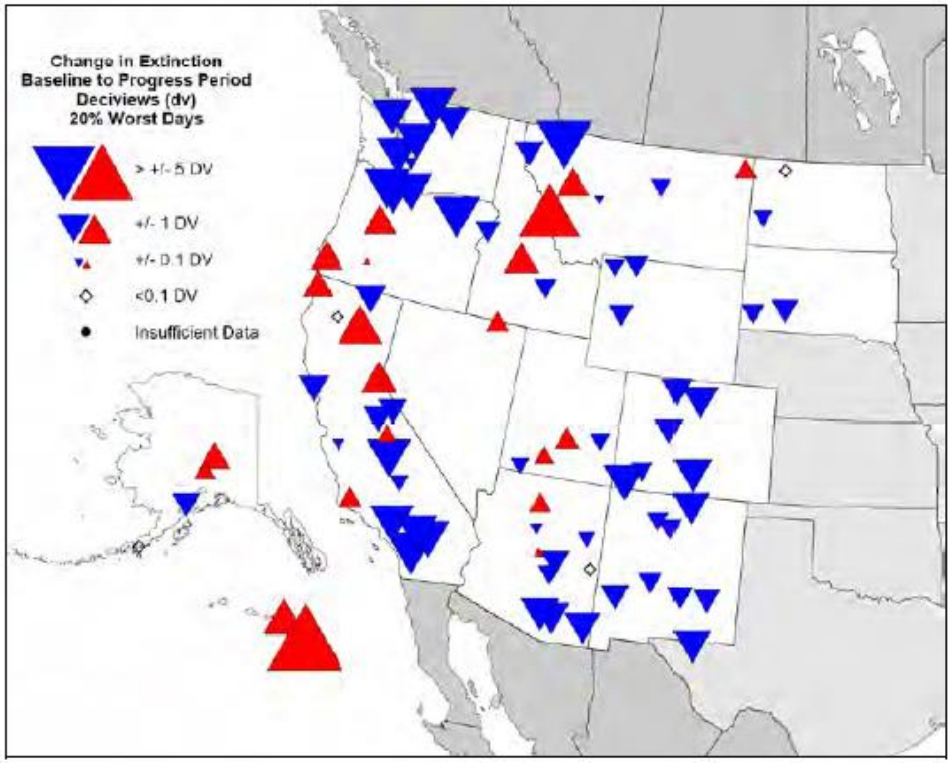

Figure 3.1. Change in Deciview Extinction between Baseline Period Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Worst Visibility Days

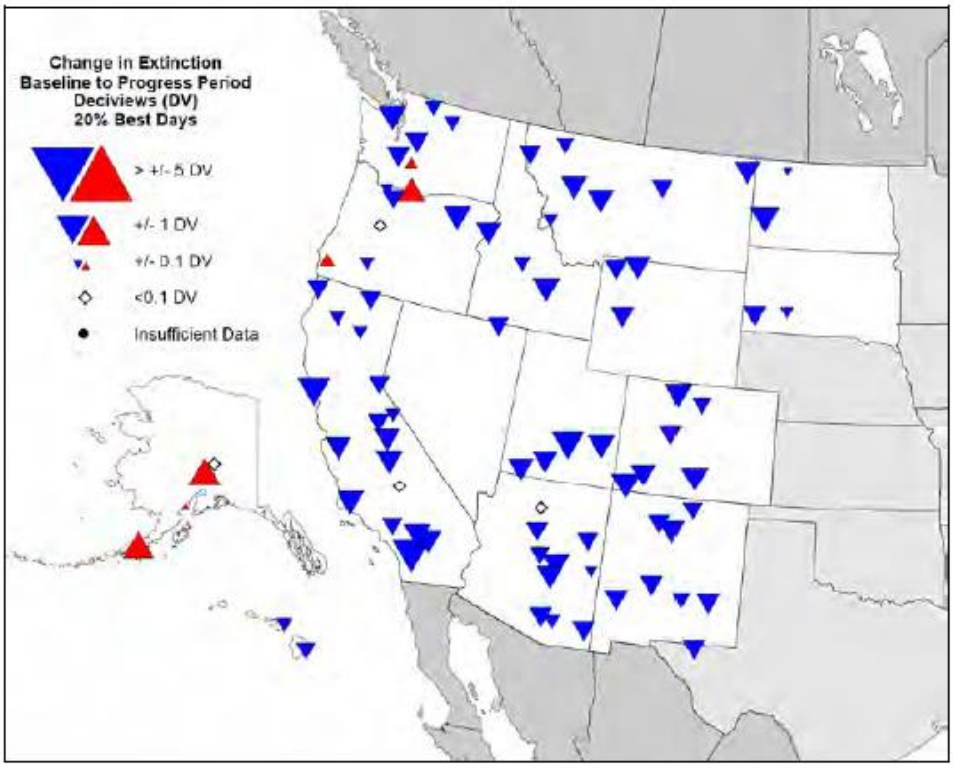

Figure 3.2. Change in Deciview Extinction between Baseline Period Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Best Visibility Days

The RH rule haze index, as defined using deciview units, does not provide information regarding the relative contributions of specific pollutants to overall visibility impairment. The calculation of visibility impairment is based on the cumulative impacts of several different species measures at IMPROVE network sites. Analyzing the behavior of each individual species has important implications for control measures, as some species originate from largely anthropogenic sources while others may originate form a mixture of both anthropogenic and natural sources.

Figures 3.3 and 3.4 present regional maps of average aerosol extinction for the most impaired days during the baseline period (2000-2004), and the first progress period average (2005-2009), respectively, for the IMPROVE monitors representing Federal Class I areas in the WRAP region. The size of the pie chart is related to the magnitude of visibility impairment, and colors represent the relative contribution of the pollutants measured by the IMPROVE network.

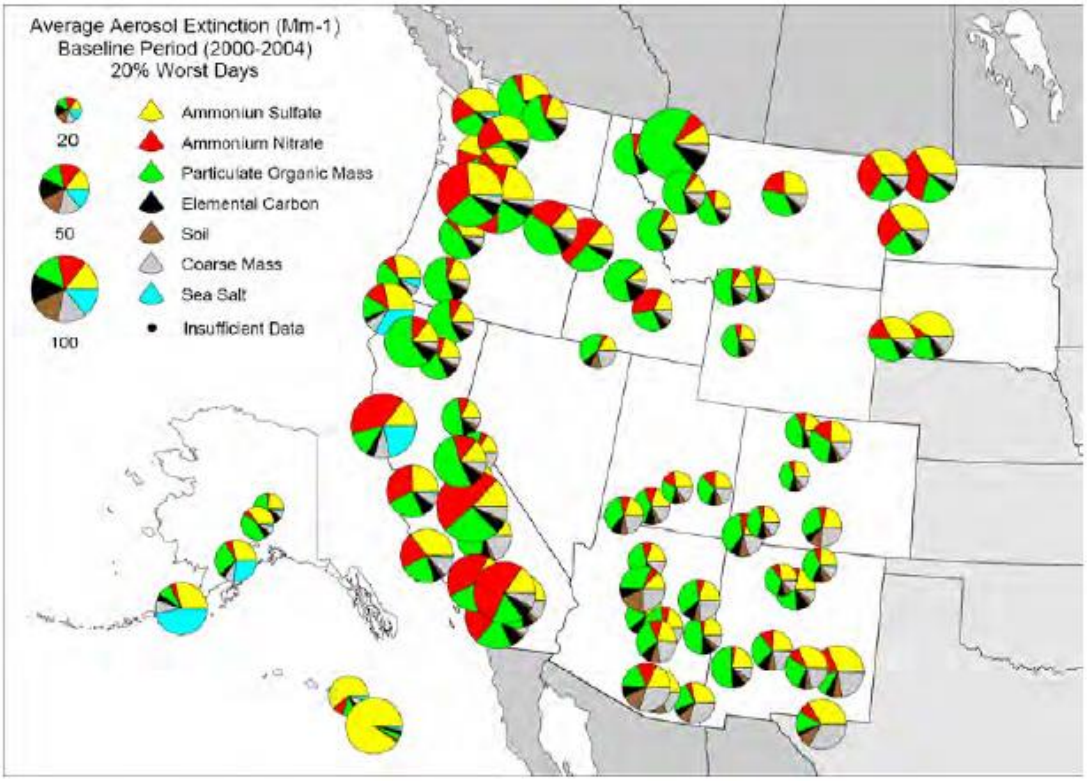

Figure 3.3. Regional Average of Aerosol Extinction by Pollutant for Baseline Period average (2000-2004) for 20% Worst Days.

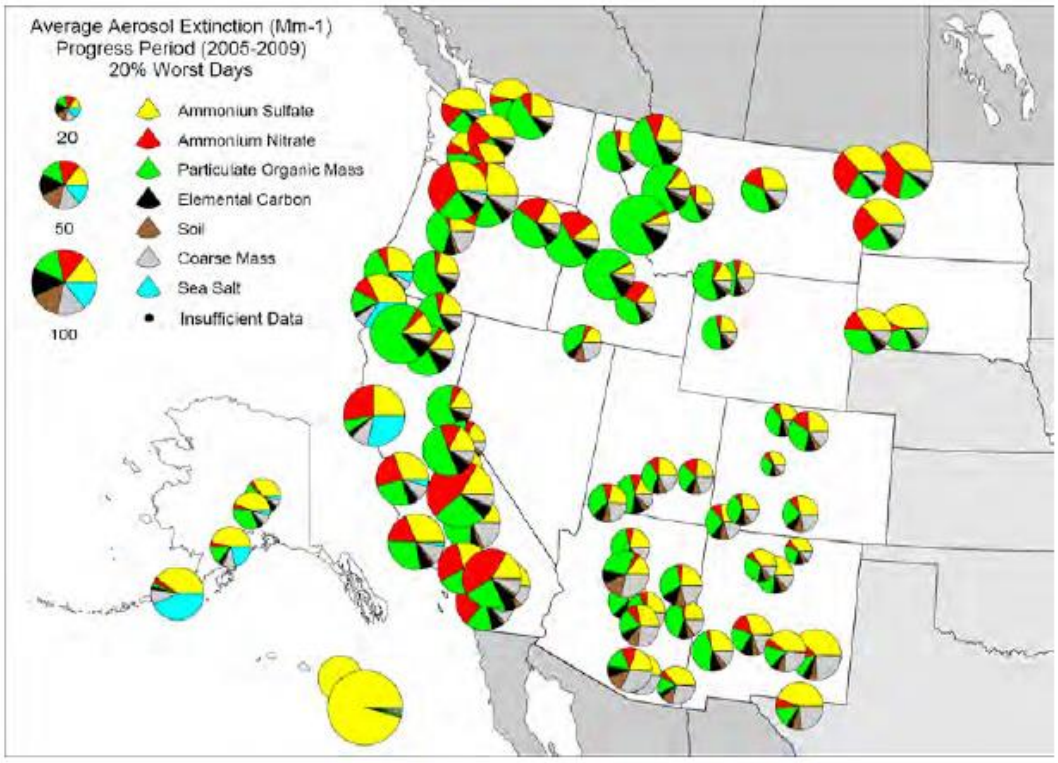

Figure 3.4. Regional Average of Aerosol Extinction by Pollutant for the First Progress Period Average (2005-2009) for 20% Worst Days.

Figure 3.5 presents the individual species of haze that have decreased between the 2000-2004 baseline period and the 2005-2009 progress period, where sites with corresponding decreases in deciview measurements are highlighted with blue circles.

For Utah, Figure 3.5 depicts most of the decreases in deciview averages that were associated with decreases in ammonium nitrate, ammonium sulfate, coarse mass and particulate organic mass. The decrease in ammonium nitrate and ammonium sulfate is most likely due to the implementation of the SO_2 milestones beginning in 2003, BART controls beginning at the end of 2006 and federal mobile source regulations. The decrease in coarse mass and particulate organic mass is likely due to the decreasing effect of natural events, such as windblown dust storms and wild fires.

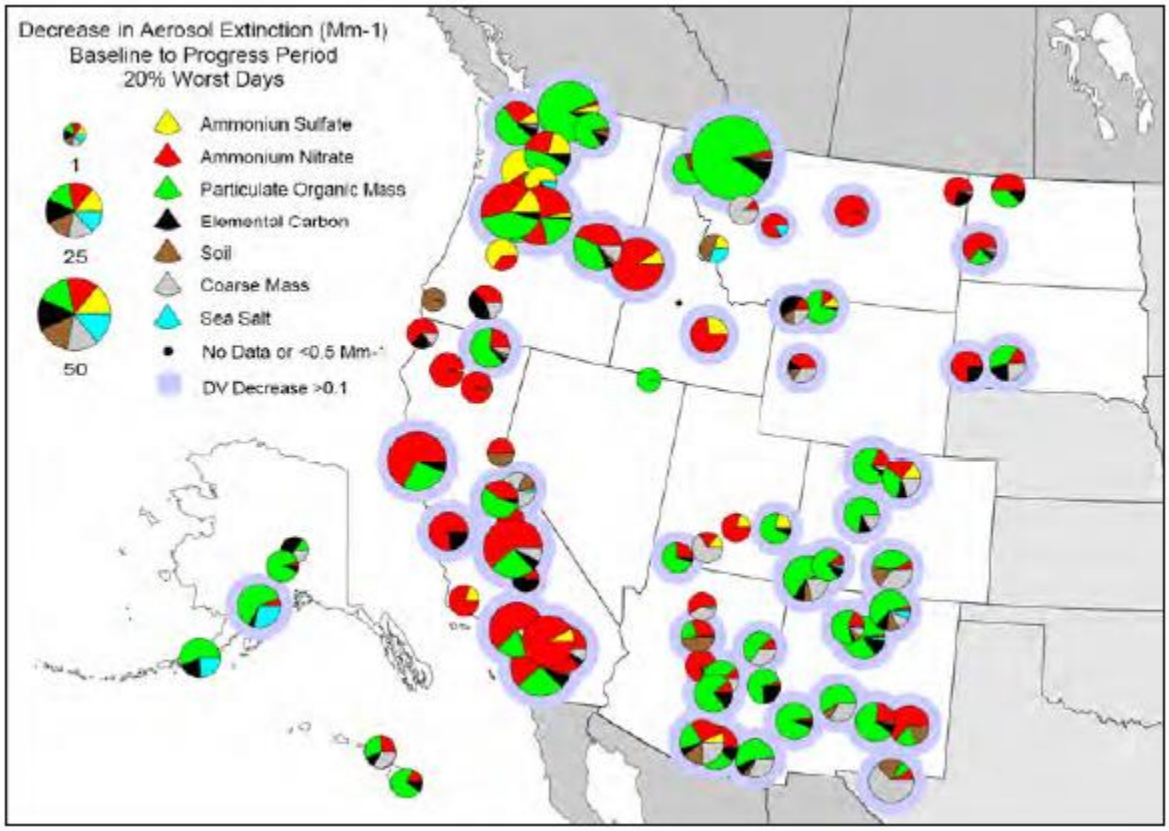

Figure 3.5. Magnitude of Aerosol Extinction Species that have Decreased Between the Baseline Average (2000-2004) and the First Progress Period Average (2005-2009) for the 20% Worst Days.

3.4 Assessment of Visibility Conditions: 40 CFR § 51.309(d)(10)(i)(C)

40 CFR § 51.309(d)(10)(i)(C) requires "*for each mandatory Class I Federal area within the State, the State must assess the following visibility conditions and changes, with values for most impaired and least impaired days expressed in terms of 5-year averages of these annual values*

The current visibility conditions for the most impaired and least impaired days;
The difference between current visibility conditions for the most impaired and least days and baseline visibility conditions;
The changes in visibility impairment for the most impaired and least impaired days over the past 5-years."

This section addresses RH rule regulatory requirements for monitored data as measured by IMPROVE monitors representing Federal Class I areas in Utah.

Regional haze progress in Federal Class I areas is tracked using calculations based on speciated aerosol mass as collected by IMPROVE monitors. The RH rule calls for tracking haze in units of deciviews, where the deciview metric was designed to be linearly associated with human perception of visibility. In a pristine atmosphere, the deciview metric is near zero, and a one deciview change is approximately equivalent to a 10% change in cumulative species extinction. To better understand visibility conditions, summaries here include both the deciview metric and the apportionment of haze into extinction due to the various measured species in units of inverse megameters (Mm^{-1}).

3.4.1 Current Visibility Conditions for the Most and Least Impaired Days

EPA guidance for the 2003 RH SIP specifies that 5-year averages be calculated over successive 5-year periods; i.e., 2000-2004, 2005-2009, 2010-2014, etc.[5] Current visibility conditions are represented in Table 3.1 and 3.2 as the most recently incorporated successive 5-year average period available, the 2005-2009 period average. While the most recent IMPROVE monitoring data currently available in the WRAP TSS includes 2012 data, the 2005-2009 period was the most recent data set available when the WRAP summary report was generated. The information and data presented in this section are from that "*Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report"* (Appendix A).

Tables 3.1 and 3.2 present the calculated deciview values for current conditions at each site, along with the percent contribution to extinction from each aerosol species for the 20% worst and best days for each of the Federal Class I area IMPROVE monitors in Utah. Appendix M of the WRAP Progress Report includes figures that represent the annual and 5-year period averages for the 20% most and least impaired visibility days at each IMPROVE site from 2000 to 2010.

Figure 3.6 presents 5-year average extinction for the current progress period for both the 20% worst and best days. Note that the percentages in the tables consider only the aerosol species which contribute to extinction, while the charts also show Rayleigh, or scattering due to background gases in the atmosphere. Specific observations for the current visibility conditions on the 20% most impaired days are as follows:

- The largest contributors to aerosol extinction at Utah sites were particulate organic mass, ammonium sulfate and coarse mass.
- The highest aerosol extinction (12.3 dv) was measured at the ZICA1 site, where particulate organic mass was the largest contributor to aerosol extinction, followed by coarse mass.
- The lowest aerosol extinction (11.0 dv) was measured at the CANY1 site.

Specific observations for the current visibility conditions on the 20% least impaired days are as follows:

- The aerosol contribution to total extinction on the beset days was less than Rayleigh, or the background scattering that would occur in clean air.
- Average extinction (including Rayleigh) ranged from 2.1 dv (BRCA2) to 4.3 dv (ZICA1).
- For all sites, ammonium sulfate was the largest contributor to the non-Rayleigh aerosol species of extinction.

[5] EPA's September 2003 Guidance for Tracking Progress Under the Regional Haze Rule specifies that progress is tracked against the 2000-2004 baseline period using corresponding averages over successive 5-year periods; i.e., 2005-2009, 2010-2014, etc. (see page 4-2 in the Guidance document).

Table 3.1, Utah Class I Area IMPROVE Sites
Current Visibility Conditions, 2005-2009 Progress Period,
20% Most Impaired Days

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BRCA1	11.9	19% (2)	9% (5)	**45% (1)**	10% (4)	5% (6)	12% (3)	0% (7)
CANY1	11.0	23% (2)	14% (4)	**27% (1)**	7% (5)	7% (6)	20% (3)	0% (7)
CAPI1	11.3	24% (2)	12% (4)	**32% (1)**	8% (5)	7% (6)	17% (3)	0% (7)
ZICA1	12.3	21% (3)	7% (5)	**33% (1)**	9% (4)	7% (6)	22% (2)	0% (7)

*Highest aerosol species contribution per site is highlighted in bold.

Table 3.2, Utah Class I Area IMPROVE Sites
Current Visibility Conditions, 2005-2009 Progress Period,
20% Least Impaired Days

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BRCA1	2.1	**40% (1)**	15% (3)	22% (2)	7% (5)	4% (6)	11% (4)	1% (7)
CANY1	2.8	**43% (1)**	12% (4)	15% (3)	7% (5)	5% (6)	17% (2)	1% (7)
CAPI1	2.7	**38% (1)**	13% (4)	21% (2)	8% (5)	5% (6)	14% (3)	1% (7)
ZICA1	4.3	**30% (1)**	11% (4)	23% (2)	10% (5)	6% (6)	18% (3)	1% (7)

*Highest aerosol species contribution per site is highlighted in bold.

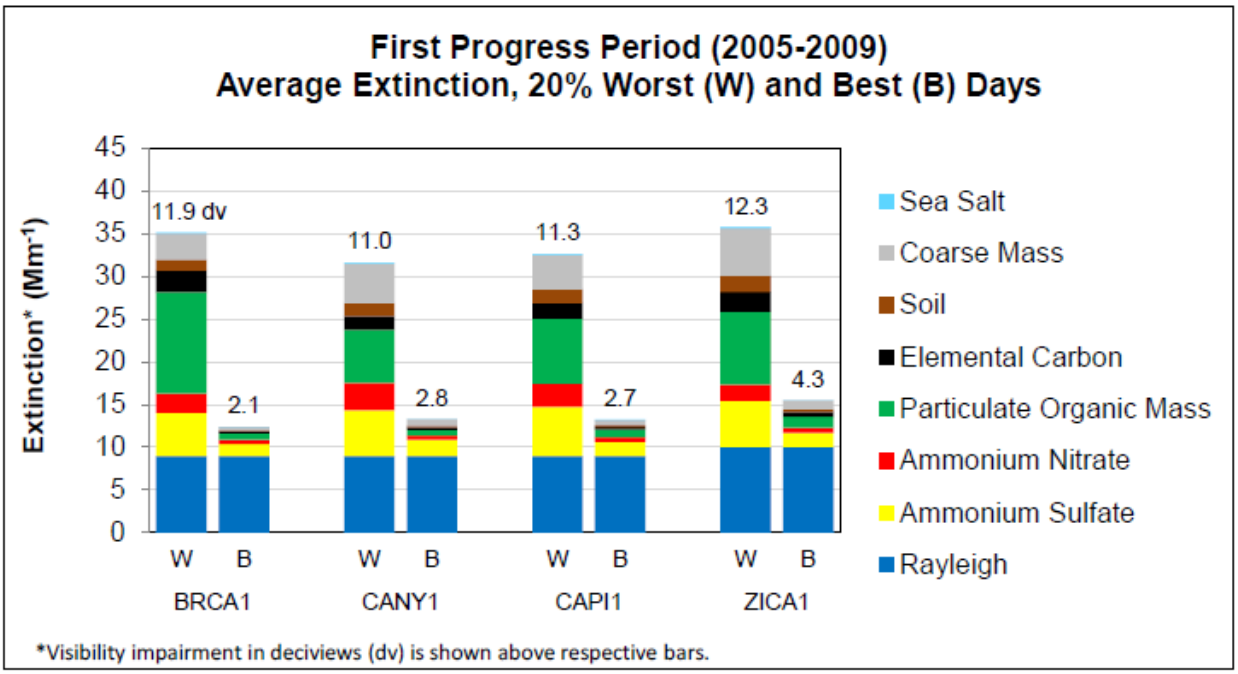

Figure 3.6. Average Extinction for Current Progress Period (2005-2009) for the Worst (Most Impaired) and Best (Least Impaired) Days Measured at Utah Class I Area IMPROVE Sites

3.4.2 Differences Between Current Visibility Conditions for the Most and Least Impaired Days and Baseline Visibility Conditions

Included here are comparisons between the 5-year average baseline conditions (2000-2004) and the current progress period extinction (2005-2009).

Table 3.3 presents the differences between the 2000-2004 baseline period average extinction and the 2005-2009 progress period average for each site in Utah for the 20% most impaired days, and Table 3.4 presents similar data for the least impaired days. Averages that increased are depicted in red text, and averages that decreased are depicted in blue.

Figure 3.7 presents the differences in the 5-year average extinction for the baseline and current progress period average for the worst days and Figure 3.8 presents the differences in averages by aerosol species, with increases represented above the zero line and decreases below the zero line. Figures 3.9 and 3.10 present similar plots for the best days.

For the 20% most impaired days, the 5-year average Regional Haze Rule (RHR) deciview metric increased between the 2000-2004 and 2005-2009 periods at the BRCA1 and CAPI1 sites and decreased at the CANY1 and ZICA1 sites. Notable differences for individual species averages were as follows:

Increases in 5-year average deciviews at the BRCA1 and CAPI1 sites were mostly due to increases in particulate organic mass, with some increases also measured in elemental carbon and soil. Coarse mass also contributed to increases at the CAPI1 site. Increases were offset by decreases in ammonium nitrate and ammonium sulfate at both sites.

Ammonium sulfate decreased at all sites except ZICA1. Note that data was not collected at the ZICA site during the baseline years, and changes reported here are proportional to average changes in extinction as measured at regional sites.

Increases in ammonium nitrate at CANY1 may be due to decreases in SO_2 emissions that reduce the formation of ammonium sulfate and therefore result in an increase in ammonium nitrate in ammonia limited conditions.

For the 20% least impaired days, the 5-year average deciview metric decreased at all sites. Notable differences for individual species averages on the 20% least impaired days were as follows:

All species at all sites either decreased or stayed the same between the baseline and current progress period for the best days. The largest decreases on the best days were measured in particulate organic mass, ammonium nitrate, ammonium sulfate, and coarse mass.

Table 3.3. Utah Class I Area IMPROVE Sites
Difference in Aerosol Extinction by Species, 2000-2004 Baseline Period to 2005-2009 Progress Period

Site	Deciview (dv)			Change in Extinction by Species (Mm^{-1})*						
	2000-04 Baseline Period	2005-09 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
BRCA1	11.6	11.9	+0.3	-0.2	-0.3	+2.5	+0.2	+0.1	-0.9	0.0
CANY1	11.2	11.0	-0.2	-0.3	+0.3	-0.9	-0.1	+0.1	+0.8	0.0
CAPI1	10.9	11.3	+0.4	-0.2	-0.7	+1.8	+0.2	+0.3	+0.7	+0.1
ZICA1	12.5	12.3	-0.2	+0.2	-0.3	-0.8	-0.1	+0.1	0.0	+0.1

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction and values in blue indicate decreases.

Table 3.4. Utah Class I Area IMPROVE Sites
Difference in Aerosol Extinction by Species, 2000-2004 Baseline Period to 2005-2009 Progress Period
20% Least Impaired Days

Site	Deciview (dv)			Change in Extinction by Species (Mm^{-1})*						
	2000-04 Baseline Period	2005-09 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
BRCA1	2.8	2.1	-0.7	-0.1	-0.2	-0.3	-0.2	0.0	-0.1	0.0
CANY1	3.7	2.8	-0.9	-0.3	-0.1	-0.5	-0.1	-0.1	-0.2	0.0
CAPI1	4.1	2.7	-1.4	-0.3	-0.4	-0.5	-0.3	-0.1	-0.4	0.0
ZICA1	5.0	4.3	-0.7	-0.1	-0.2	-0.5	-0.2	0.0	-0.1	0.0

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction and values in blue indicate decreases.

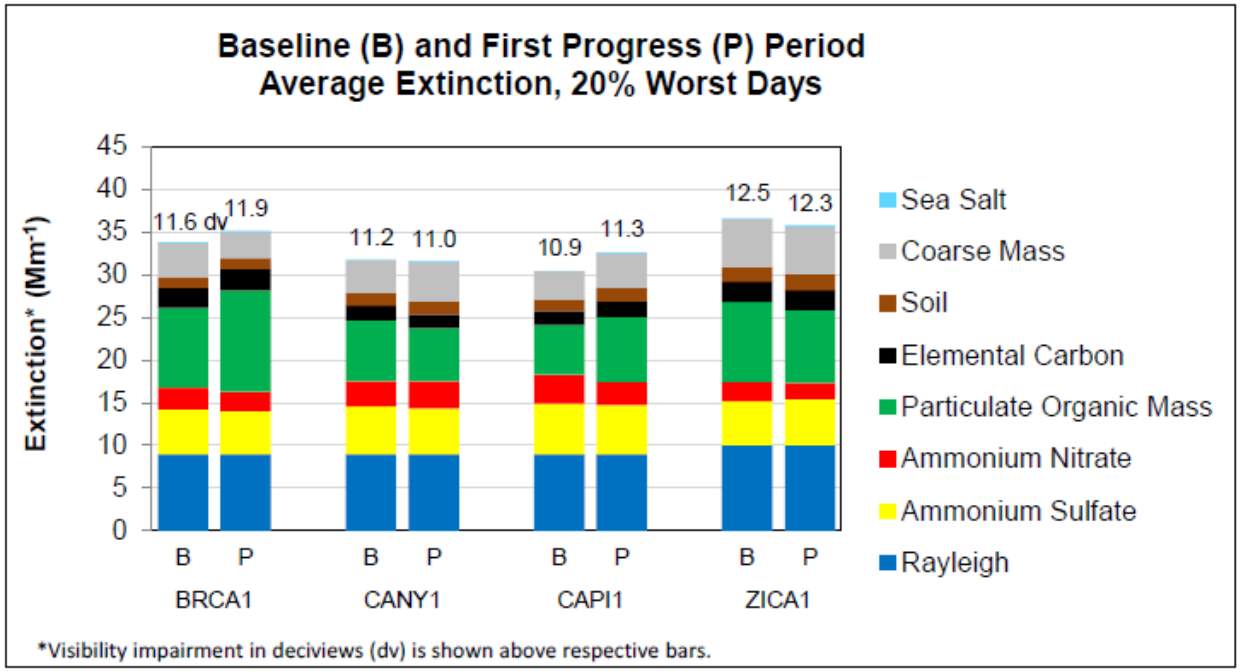

Figure 3.7. Average Extinction for Baseline and Progress Period Extinction for Worst (Most Impaired) Days Measured at Utah Class I Area IMPROVE Sites.

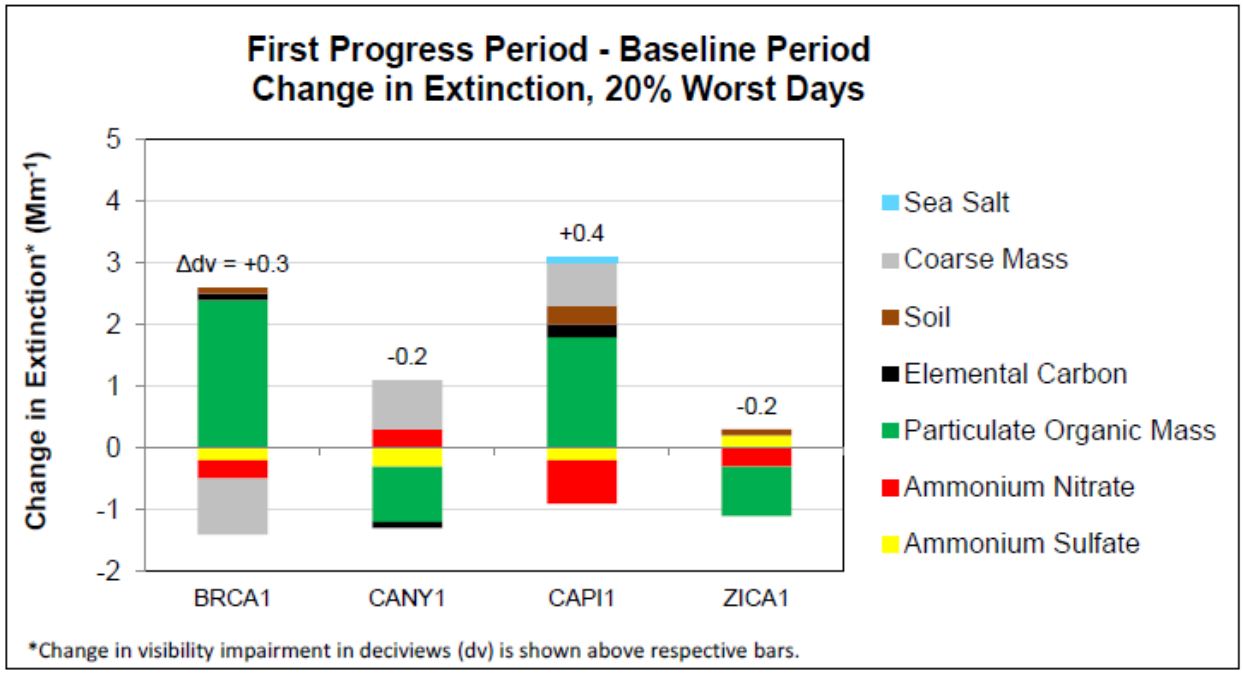

Figure 3.8. Difference between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Worst (Most Impaired) Days Measured at Utah Class I Area IMPROVE Sites.

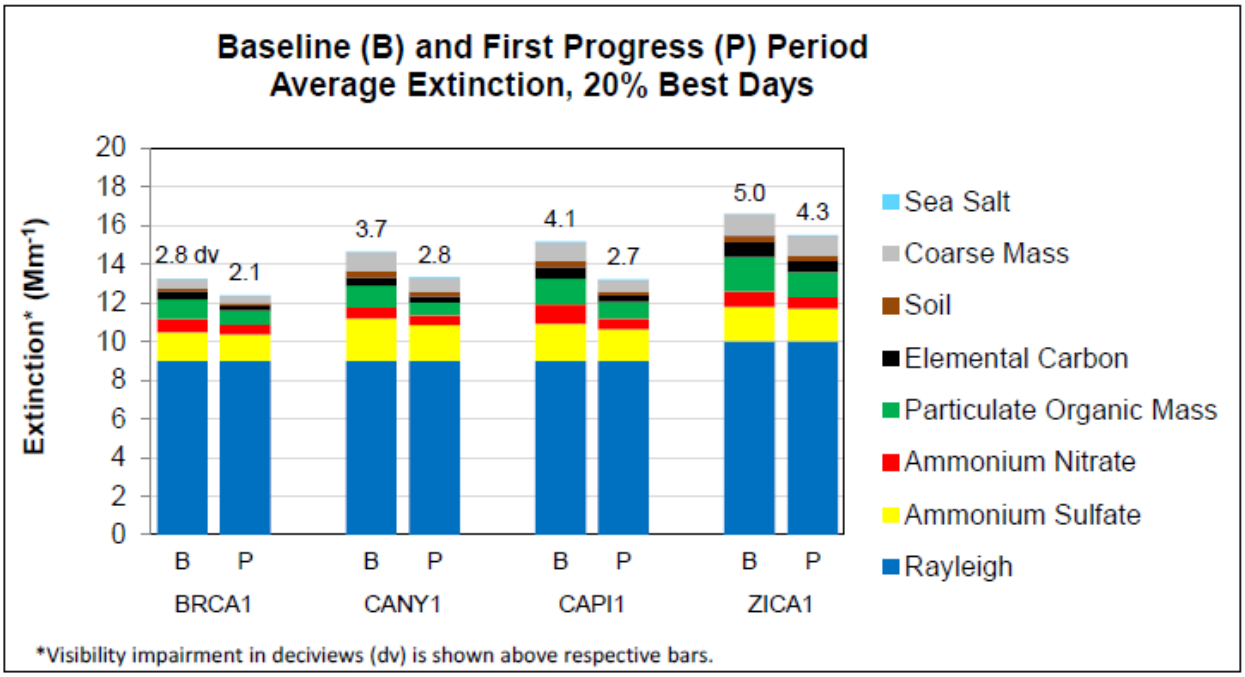

Figure 3.9. Average Extinction for Baseline and Progress Period Extinction for Best (Least Impaired) Days Measured at Utah Class I Area IMPROVE Sites

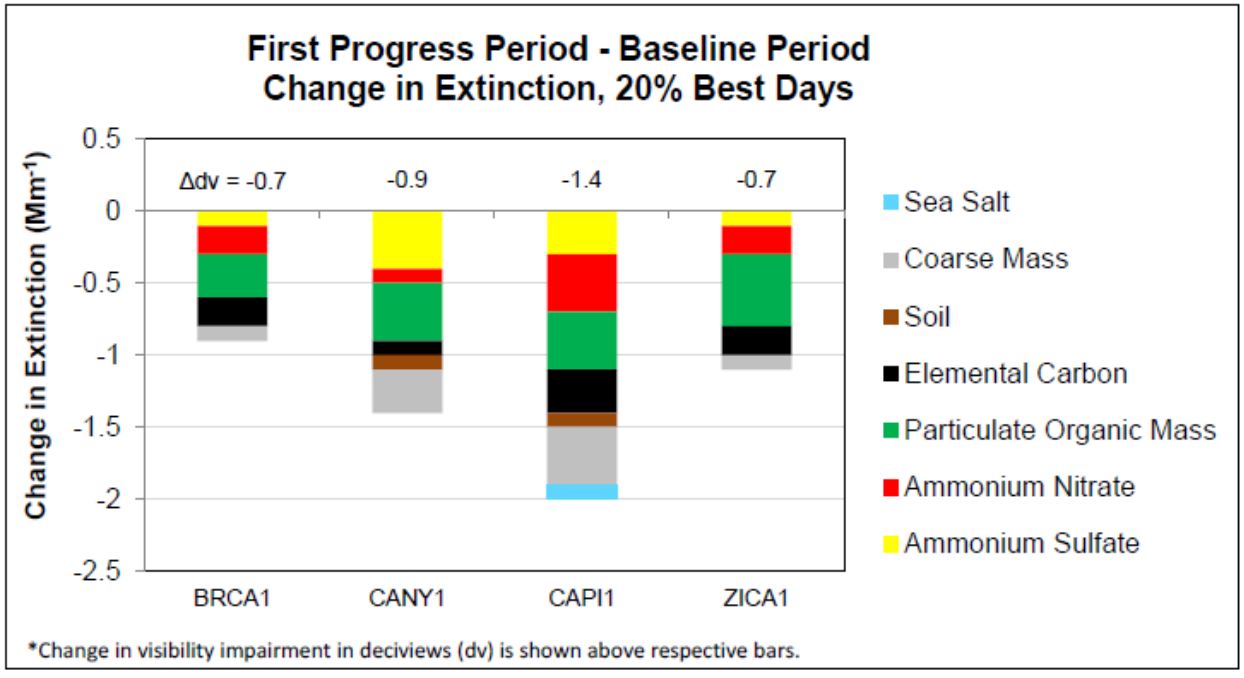

Figure 3.10. Difference Between Average Extinction for Current Progress Period (2005-2009) and Baseline Period (2000-2004) for the Best (Least Impaired) Days Measured at Utah Class I Area IMPROVE Sites

3.4.3 Change in Visibility Impairment for the Most Impaired and Least Impaired Days Over the Past Five Years

Included here are changes in visibility impairment as characterized by annual average trend statistics and some general observations regarding local and regional events and outliers on a daily and annual basis that affected the current 5-year progress period. The regulatory requirement asks for a description of changes over the past 5-year progress period, but trend analysis is better suited to longer periods of time, so trends for the entire 10-year planning period are presented here.

Trend statistics for the years 2000-2009 for each species at each site in Utah are summarized in Table 3.5[6]. Only trends for aerosol species trends with p-value statistics less than 0.15 (85% confidence level) are presented in the table here, with increasing slopes in red and decreasing slopes in blue[7]. In some cases, trends may show decreasing tendencies while the difference between the 5-year averages do not (or vice versa). In these cases, the 5-year average for the best and worst days is the important metric for the RHR regulatory purposes, but trend statistics may be of value to understand and address visibility impairment issues for planning purposes.

For each site, a more comprehensive list of all trends for all species, including the associated p-values, is provided in Appendix M of the *Western Regional Air Partnership Regional Haze Rule Reasonable Progress Summary Report*. Additionally, the appendix includes plots depicting 5-year, annual, monthly and daily average extinction for each site. Some general observations regarding changes in visibility impairment at sites in Utah are as follows:

- Particulate organic mass was the largest contributor to aerosol extinction at all sits in Utah. The largest difference between the 5-year average baseline and progress periods was measured for particulate organic mass at the BRCA1 site. This difference average was influenced by high particulate organic mass events in July and August, 2009.

- For ammonium sulfate, annual average trend statistics for all measured days indicated decreasing trends at all Utah sites. A slight increase in the 5-year average ammonium sulfate was reported for the ZICA1 site, but this was based on a baseline average estimate (Section 6.13.1.1 of Appendix M of the WRAP Report). Actual data measured between 2004 and 2009 at the ZICA1 site indicated a slightly decreasing annual average trend.

[6] Annual trends were calculated for the years 2000-2009, with a trend defined as the slope derived using Theil statistics. Trends derived from Theil statistics are useful in analyzing changes in air quality data because these statistics can show the overall tendency of measurements over long periods of time, while minimizing the effects of year-to-year fluctuations which are common in air quality data. Theil statistics are also used in EPA's National Air EPA's National Air Quality Trends Reports (http://www.epa.gov/airtrends/) and the IMPROVE program trend reports (http://vista.cira.colostate.edu/improve/Publications/improve_reports.htm)

[7] The significance of the trend is represented with p-values calculated using Mann-Kendall trend statistics. Determining a significance level helps to distinguish random variability in data from a real tendency to increase or decrease over time, where lower p-values indicate higher confidence levels in the computed slopes.

- For ammonium nitrate, annual average trend statistics for all measured days indicated a decreasing trend at the CAPI1 site and either no trend or insignificant trends at the other Utah sites.

- For soil, slightly increasing annual average tends were measured at the ZICA1 site and an increasing trend for the worst days was measured at the CAPI1 site.

- Coarse mass increased at the CAPI1 and CANY1 sites, but these sites did not show increasing trends. Higher 5-year current period averages were influenced by higher than average coarse mass events in late April of 2008 at both sites.

Table 3.5. Utah Class I Area IMPROVE Sites
Change in Aerosol Extinction by Species
200-2009 Annual Average Trends

Site	Group	Annual Trend* (Mm^{-1}/year)						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BRCA1	20% Best	--	0.0	-0.1	0.0	--	0.0	0.0
	20% Worst	-0.2	--	0.5	0.1	--	--	0.0
	All Days	-0.1	0.0	--	--	--	--	--
CANY1	20% Best	-0.1	--	-0.1	0.0	--	-0.1	0.0
	20% Worst	-0.1	--	--	--	--	--	0.0
	All Days	-0.1	0.0	--	0.0	0.0	--	0.0
CAPI1	20% Best	-0.1	-0.1	-0.1	0.0	--	-0.1	--
	20% Worst	--	-0.2	--	--	0.1	--	0.0
	All Days	-0.1	-0.1	--	0.0	--	--	0.0
ZICA1	20% Best	0.0	--	--	0.0	0.0	--	0.0
	20% Worst	-0.5	--	--	--	--	--	--
	All Days	-0.2	--	--	-0.1	0.1	--	--

3.5 Analysis of Emissions: 40 CFR 40 CFR § 51.309(d)(10)(i)(D)

40 CFR §51.309(d)(10(i)(D) requires "*An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.*"

Included here are summaries depicting differences between two emission inventory years that are used to represent the 5-year baseline and current progress periods. The baseline period is represented using a 2002 inventory developed by the WRAP for use in the initial WRAP state SIPs, and the progress period is represented by a 2008 inventory which leverages recent WRAP inventory work for modeling efforts. For reference, Table 3.6 lists the pollutants inventoried, the related aerosol species, some of the key sources for each pollutant, and some notes regarding implications of these pollutants. Differences between these

baseline and progress period inventories, and a separate summary of annual emissions from electrical generating units (EGUs), are presented in this section.

Table 3.6
Utah
Pollutants, Aerosol Species, and Major Sources

Emitted Pollutant	Related Aerosol	Major Sources	Notes
Sulfur Dioxide (SO_2)	Ammonium Sulfate	Point Sources; On- and Off-Road Mobile Sources	SO_2 emissions are generally associated with anthropogenic sources such as coal-burning power plants, other industrial sources such as refineries and cement plants, and both on- and off-road diesel engines.
Oxides of Nitrogen (NO_X)	Ammonium Nitrate	On- and Off-Road Mobile Sources; Point Sources; Area Sources	NO_X emissions are generally associated with anthropogenic sources. Common sources include virtually all combustion activities, especially those involving cars, trucks, power plants, and other industrial processes.
Ammonia (NH_3)	Ammonium Sulfate and Ammonium Nitrate	Area Sources; On-Road Mobile Sources	Gaseous NH_3 has implications in particle formation because it can form particulate ammonium. Ammonium is not generally directly measured by the IMPROVE program, but affects formation potential of ammonium sulfate and ammonium nitrate. All measured nitrate and sulfate is assumed to be associated with ammonium for IMPROVE reporting purposes.
Volatile Organic Compounds (VOCs)	Particulate Organic Mass (POM)	Biogenic Emissions; Vehicle Emissions; Area Sources	VOCs are gaseous emissions of carbon compounds, which are often converted to POM through chemical reactions in the atmosphere. Estimates for biogenic emissions of VOCs have undergone significant updates since 2002, so changes reported here are more reflective of methodology changes than actual changes in emissions (see Section 3.2.1).
Primary Organic Aerosol (POA)	POM	Wildfires; Area Sources	POA represents organic aerosols that are emitted directly as particles, as opposed to gases. Wildfires in the west generally dominate POA emissions, and large wildfire events are generally sporadic and highly variable from year-to-year.
Elemental Carbon (EC)	EC	Wildfires; On- and Off-Road Mobile Sources	Large EC events are often associated with large POM events during wildfires. Other sources include both on- and off-road diesel engines.
Fine Soil	Soil	Windblown Dust; Fugitive Dust; Road Dust; Area Sources	Fine soil is reported here as the crustal or soil components of $PM_{2.5}$.
Coarse Mass (PMC)	Coarse Mass	Windblown Dust; Fugitive Dust	Coarse mass is reported by the IMPROVE Network as the difference between PM_{10} and $PM_{2.5}$ mass measurements. Coarse mass is not separated by species in the same way that $PM_{2.5}$ is speciated, but these measurements are generally associated with crustal components. Similar to crustal $PM_{2.5}$, natural windblown dust is often the largest contributor to PMC.

For these summaries, emissions during the baseline years are represented using a 2002 inventory, which was developed with support from the WRAP for use in the original RH SIP strategy development (termed plan02d). Differences between inventories are represented as the difference between the 2002 inventory and a 2008 inventory which leverages recent inventory development work performed by the WRAP for the West-wide Jumpstart Air Quality Modeling Study (WestJumpAQMS) and Deterministic & Empirical Assessment of Smoke's contribution to Ozone ($DEASCO_3$) modeling projects (termed WestJump2009). Note that the comparison of differences between inventories does not necessarily reflect a change in emissions, as a number of methodology changes and enhancements have occurred between development of the individual inventories (See Appendix A). Inventories for all major visibility impairing pollutants are presented for major source categories, and categorized as either anthropogenic or natural emissions.

Table 3.7 and Figure 3.11 present the differences between the 2002 and 2008 sulfur dioxide (SO_2) inventories by source category. Table 3.8 and Figure 3.11 present data for oxides of nitrogen (NO_x), and Tales 3.9 through 3.14 and Figures 3.12 through 3.18 present data for ammonia (NH_3), volatile organic compounds (VOCs), primary organic aerosol (POA), elemental carbon (EC), fine soil, and coarse mass. General observations regarding emissions inventory comparisons are listed below.

- The largest differences for point source inventories were a decrease in SO_2 emissions and an increase in NO_X.
- Area source inventories showed decreases in SO_2 and increases in NO_X, NH_3, POA, and VOCs. These changes may be due to a combination of population changes and differences in methodologies used to estimate these emissions (see Section 3.2.1 of Appendix A). One methodology change was the reclassification of some off-road mobile sources (such as some types of marine vessels and locomotives) into the area source category in 2008, which may have contributed to increases in area source inventory totals, but decreases in off-road mobile totals.
- On-road mobile source inventory comparisons showed decreases in most parameters, especially NOX and VOCs, with increases in POA, EC, and coarse mass. Reductions in NOX and VOC are likely influenced by federal and state emissions standards that have already been implemented. The increases in POA, EC, and coarse mass occurred in all of the WRAP states for on-road mobile inventories, regardless of reductions in NO_X and VOCs, indicating that these increases were likely due use of different on-road models, as referenced in Section 3.2.1 of Appendix A.
- Off-road mobile source inventories showed decreases in NO_x, SO_2, and VOCs, and increases in fine soil and coarse mass, which was consistent with most contiguous WRAP states. These differences were likely due to a combination of actual changes in source contributions and methodology differences, as referenced in Section 3.2.1 of Appendix A. As noted previously, one major methodology difference was the reclassification of some off-road mobile sources (such as some types of marine vessels and locomotives) into the area source category in 2008, which may have contributed to decreases in the off-road inventory totals, but increases in area source totals.
- Inventory comparison results for area oil and gas showed an increase in NOX and a decrease in VOCs. Note that inventory methodologies for these sources may have evolved substantially between the baseline and 2008 inventories as referenced in Section 3.2.1. Also, WRAP Phase III oil and gas inventories are reported here for entire basins, and include oil and gas emissions within tribal boundaries.

- For most parameters, especially POAs, VOCs, and EC, fire emission inventory estimates decreased. Note that these differences are not necessarily reflective of changes in monitored data, as the baseline period is represented by an average of 2000-2004 fire emissions, and the progress period is represented only by the fires that occurred in 2008, as referenced in Section 3.2.1 of Appendix A.
- Comparisons between VOC inventories showed large decreases in biogenic emissions, which was consistent with other contiguous WRAP states. Estimates for biogenic emissions of VOCs have undergone significant updates since 2002, so changes reported here are more reflective of methodology changes than actual changes in emissions, as referenced in Section 3.2.1 of Appendix A.
- Fine soil and coarse mass increased for the windblown dust inventory comparisons and the combined fugitive/road dust inventories. Large variability in changes in windblown dust was observed for the contiguous WRAP states, which was likely due in large part to enhancements in dust inventory methodology rather than in changes in actual emissions.

Table 3.7
Sulfur Dioxide Emissions by Category

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	41,863	28,206	-13,658
Area	3,434	1,988	-1,447
On-Road Mobile	1,777	497	-1,280
Off-Road Mobile	4,504	286	-4,218
Area Oil and Gas	17	114	98
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	70	8	-62
Total Anthropogenic	**51,665**	**31,099**	**-20,566 (-40%)**
Natural Sources			
Natural Fire	2,418	92	-2,326
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**2,418**	**92**	**-2,326 (-96%)**
All Sources			
Total Emissions	**54,083**	**31,190**	**-22,892 (-42%)**

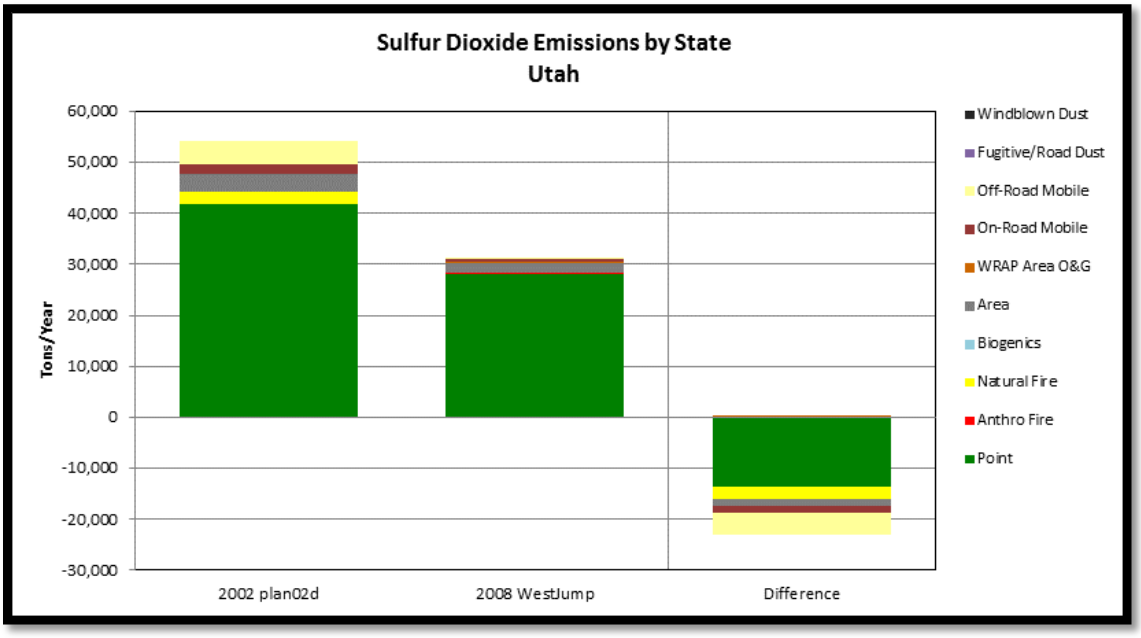

Figure 3.11. 2002 and 2008 Emission and Difference between Emissions Inventory Totals, for Sulfur Dioxide by Source Category for Utah

Table 3.8
Oxides of Nitrogen Emissions by Category

Source Category	Oxides of Nitrogen Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	84,218	87,623	3,405
Area	6,146	17,269	11,124
On-Road Mobile	77,381	64,186	-13,195
Off-Road Mobile	47,100	13,249	-33,851
Area Oil and Gas	3,335	4,136	801
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	319	65	-254
Total Anthropogenic	**218,499**	**186,528**	**-31,971 (-15%)**
Natural Sources			
Natural Fire	8,873	650	-8,223
Biogenic	12,597	6,144	-6,453
Wind Blown Dust	0	0	0
Total Natural	**21,470**	**6,793**	**-14,676 (-68%)**
All Sources			
Total Emissions	**239,969**	**193,322**	**-46,647 (-19%)**

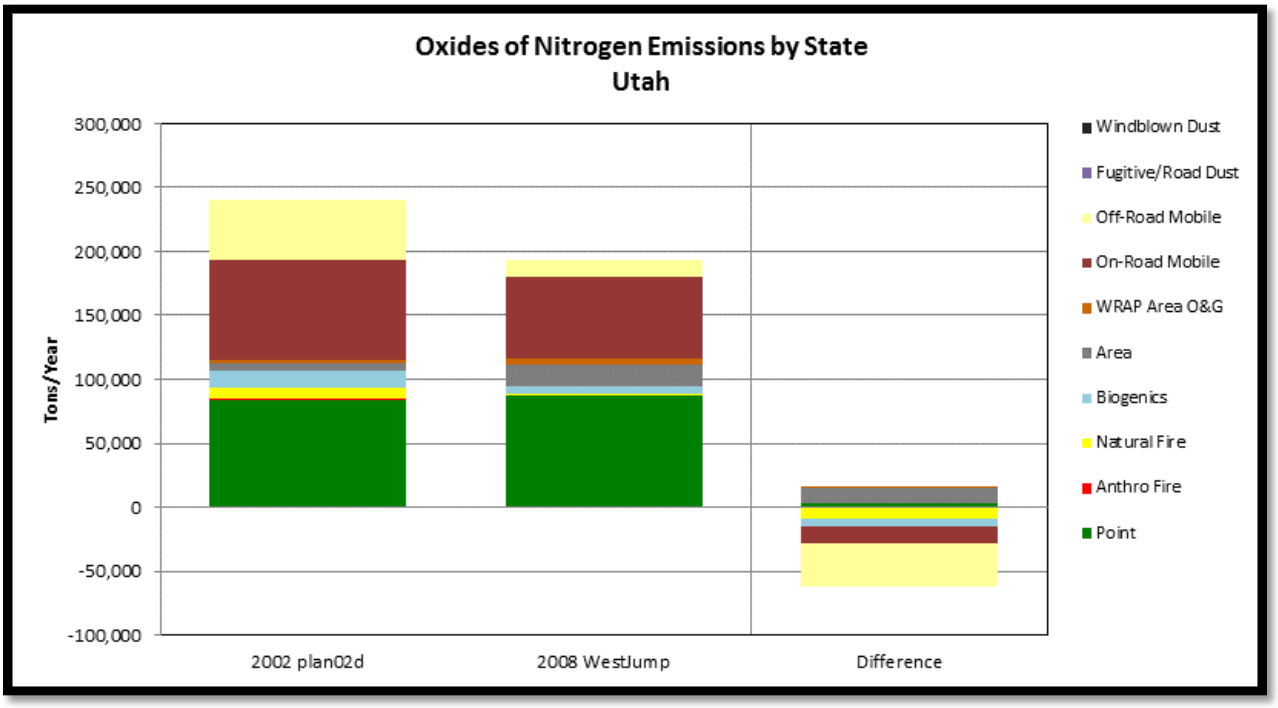

Figure 3.12. 2002 and 2008 Emissions and Difference between Emissions Inventory Totals, for Oxides of Nitrogen by Source Category for Utah

Table 3.9
Ammonia Emissions by Category

Source Category	Ammonia Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	1,905	556	-1,349
Area	23,642	37,639	13,997
On-Road Mobile	2,453	1,048	-1,405
Off-Road Mobile	32	16	-16
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	75	37	-38
Total Anthropogenic	**28,107**	**39,295**	**11,189 (40%)**
Natural Sources			
Natural Fire	1,893	449	-1,444
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**1,893**	**449**	**-1,444 (-76%)**
All Sources			
Total Emissions	**29,999**	**39,744**	**9,744 (32%)**

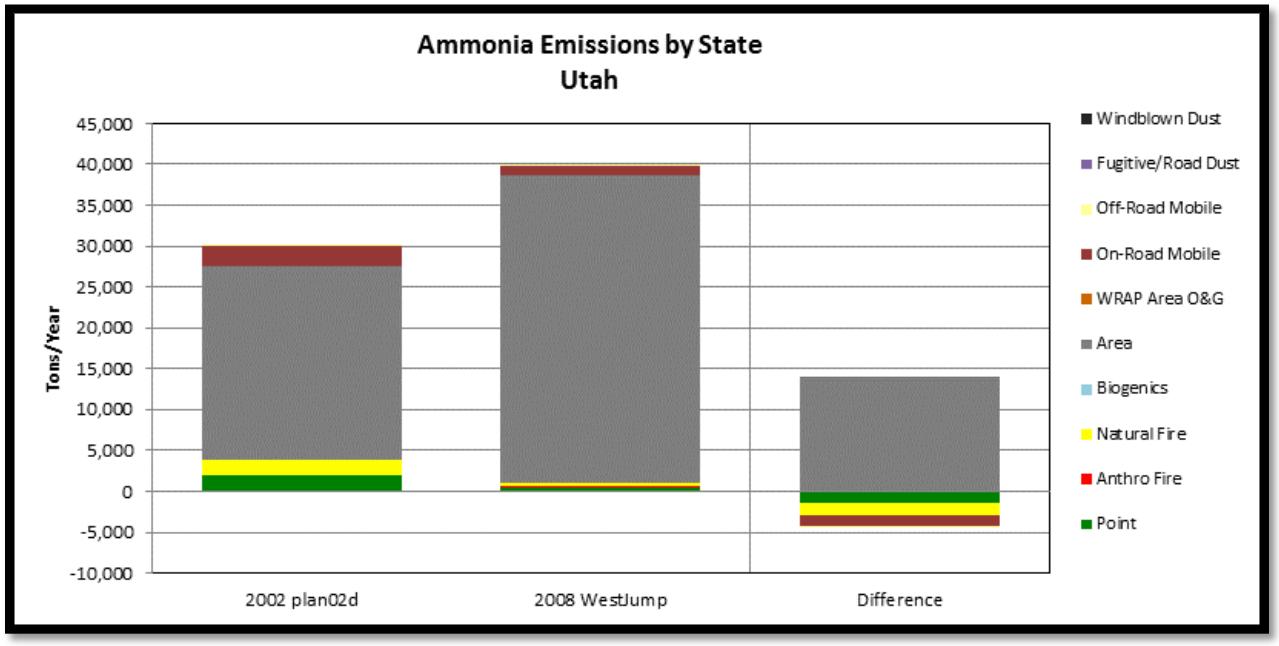

Figure 3.13. 2002-2008 Emission and Difference between Emission Inventory Totals, for Ammonia by Source Category for Utah

Table 3.10
Volatile Organic Compound Emissions by Category

Source Category	Volatile Organic Compound Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	7,367	9,285	1,919
Area	46,679	72,811	26,132
On-Road Mobile	49,075	27,138	-21,937
Off-Road Mobile	26,933	23,213	-3,720
Area Oil and Gas	35,961	25,358	-10,603
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	536	126	-410
Total Anthropogenic	**166,550**	**157,931**	**-8,619 (-5%)**
Natural Sources			
Natural Fire	19,484	720	-18,764
Biogenic	641,481	237,799	-403,682
Wind Blown Dust	0	0	0
Total Natural	**660,965**	**238,518**	**-422,446 (-64%)**
All Sources			
Total Emissions	**827,515**	**396,449**	**-431,065 (-52%)**

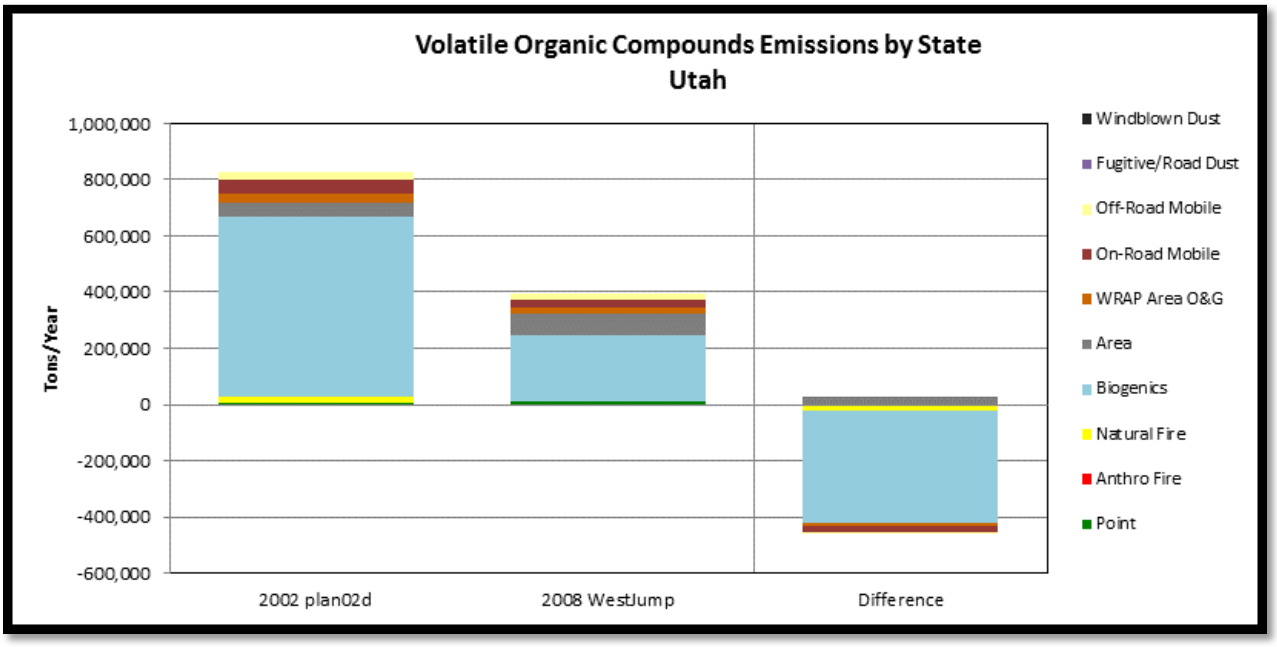

Figure 3.14. 2002-2008 Emission and Difference between Emission Inventory Totals, for Volatile Organic Compounds by Source Category for Utah

Table 3.11
Primary Organic Aerosol Emissions by Category

Source Category	Primary Organic Aerosol Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	392	75	-317
Area	578	3,045	2,468
On-Road Mobile	637	1,573	937
Off-Road Mobile	965	666	-299
Area Oil and Gas	0	28	28
Fugitive and Road Dust	141	886	745
Anthropogenic Fire	507	106	-401
Total Anthropogenic	**3,219**	**6,380**	**3,161 (98%)**
Natural Sources			
Natural Fire	26,187	1,167	-25,020
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**26,187**	**1,167**	**-25,020 (-96%)**
All Sources			
Total Emissions	**29,407**	**7,547**	**-21,859 (-74%)**

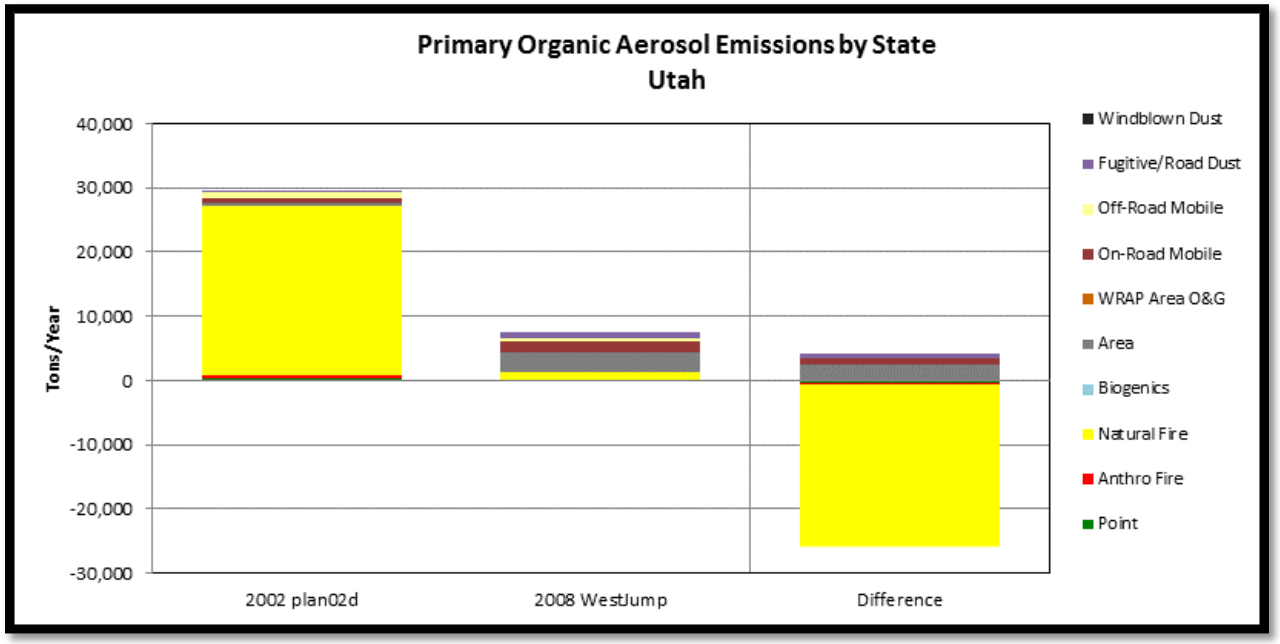

Figure 3.15. 2002-2008 Emission and Difference between Emission Inventory Totals, for Primary Organic Aerosol by Source Category for Utah

Table 3.12
Elemental Carbon Emissions by Category

Source Category	Elemental Carbon Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	102	24	-77
Area	12	513	500
On-Road Mobile	663	2,593	1,930
Off-Road Mobile	2,492	715	-1,777
Area Oil and Gas	0	0	0
Fugitive and Road Dust	11	21	11
Anthropogenic Fire	85	23	-62
Total Anthropogenic	**3,364**	**3,889**	**525 (16%)**
Natural Sources			
Natural Fire	5,405	209	-5,196
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	**5,405**	**209**	**-5,196 (-96%)**
All Sources			
Total Emissions	**8,769**	**4,098**	**-4,671 (-53%)**

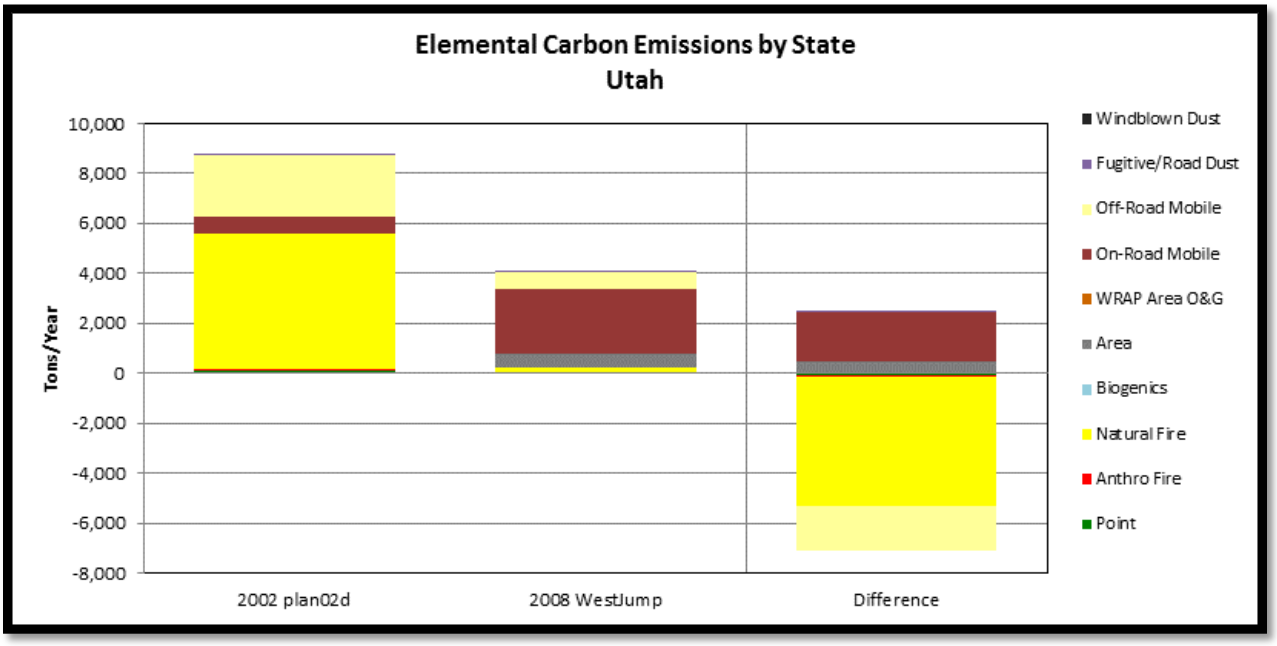

Figure 3.16. 2002-2008 Emission and Difference between Emission Inventory Totals, for Elemental Carbon by Source Category for Utah

Table 3.13
Fine Soil Emissions by Category

Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	2,933	712	-2,222
Area	160	1,595	1,435
On-Road Mobile	426	257	-170
Off-Road Mobile	0	47	47
Area Oil and Gas	0	479	479
Fugitive and Road Dust	2,411	14,164	11,753
Anthropogenic Fire	81	43	-38
Total Anthropogenic	**6,011**	**17,296**	**11,285 (>100%)**
Natural Sources			
Natural Fire	1,719	429	-1,290
Biogenic	0	0	0
Wind Blown Dust	7,573	10,810	3,237
Total Natural	**9,292**	**11,239**	**1,948 (21%)**
All Sources			
Total Emissions	**15,302**	**28,535**	**13,232 (86%)**

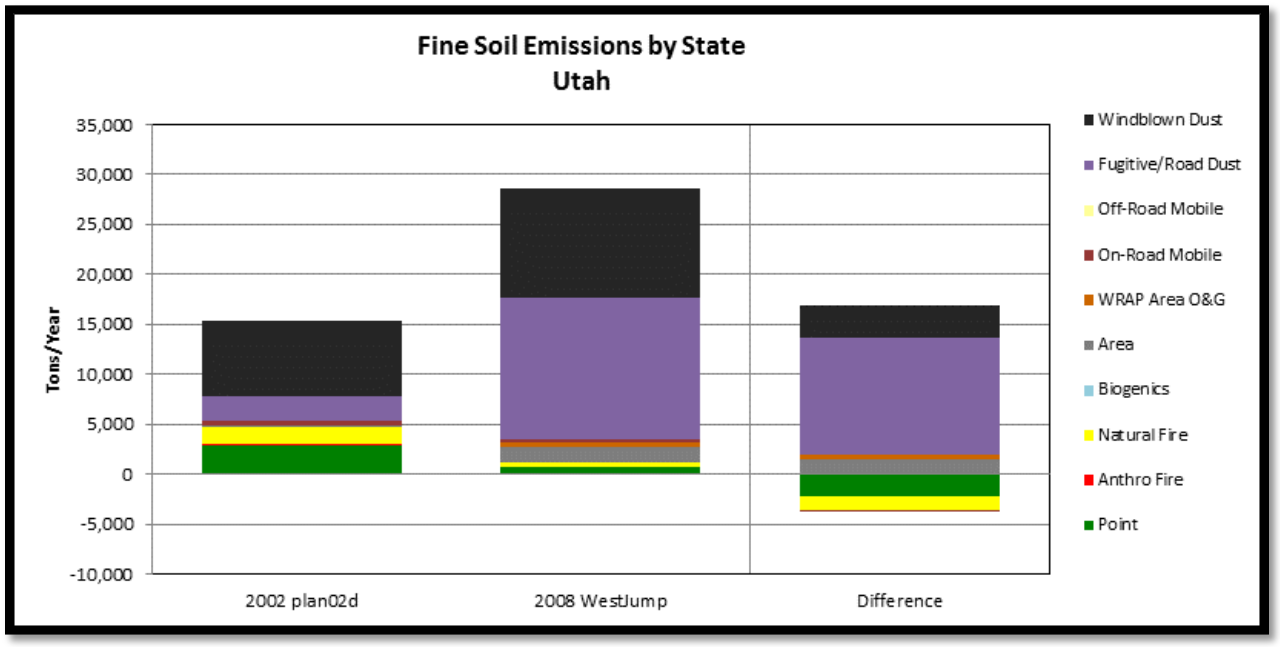

Figure 3.17. 2002-2008 Emission and Difference between Emission Inventory Totals, for Fine Soil by Source Category for Utah

Table 3.14
Coarse Mass Emissions by Category

Source Category	Coarse Mass Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	8,442	4,216	-4,226
Area	2,387	2,017	-371
On-Road Mobile	414	2,801	2,387
Off-Road Mobile	0	76	76
Area Oil and Gas	0	12	12
Fugitive and Road Dust	12,374	107,079	94,705
Anthropogenic Fire	59	20	-39
Total Anthropogenic	**23,677**	**116,221**	**92,544 (>100%)**
Natural Sources			
Natural Fire	5,671	224	-5,448
Biogenic	0	0	0
Wind Blown Dust	68,153	97,289	29,136
Total Natural	**73,824**	**97,513**	**23,689 (32%)**
All Sources			
Total Emissions	**97,501**	**213,733**	**116,233 (>100%)**

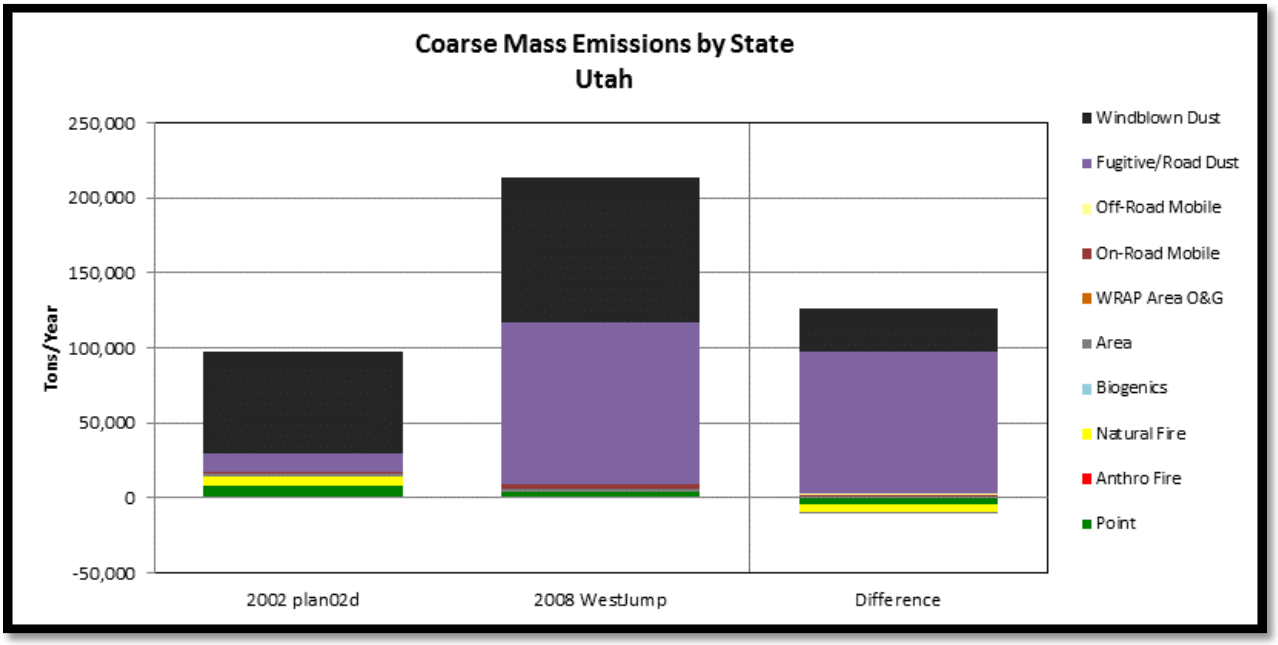

Figure 3.18. 2002-2008 Emission and Difference between Emission Inventory Totals, for Coarse Mass by Source Category for Utah

As described above, differences between the baseline and progress period inventories presented here do not necessarily represent changes in actual emissions because numerous updates in inventory methodologies have occurred between the development of the separate inventories. Also, the 2002 baseline and 2008 progress period inventories represent only annual snapshots of emissions estimates, which may not be representative of the entire 5-year monitoring periods compared. To better account for year-to-year changes in emissions, annual emissions totals for Utah electrical generating units (EGUs) are presented here. EGU emissions are some of the more consistently reported emissions, as tracked in EPA's Air Markets Program Database for permitted Title V facilities in the state (http://ampd.epa.gov/ampd). RHR implementation plans are required to pay specific attention to certain major stationary sources, including EGUs, built between 1962 and 1977.

Figure 3.19 presents a sum of annual NOx and SO_2 emissions as reported for Utah EGU sources between 1996 and 2010. While these types of facilities are targeted for controls in state regional haze SIPs, it should be noted that many of the controls planned for EGUs in the WRAP states had not taken place yet in 2010, while other controls separate from the RHR may have been implemented. The chart shows some periods of decline for both NOx and SO_2, with a sharp decline in SO_2 emissions between 2006 and 2007.

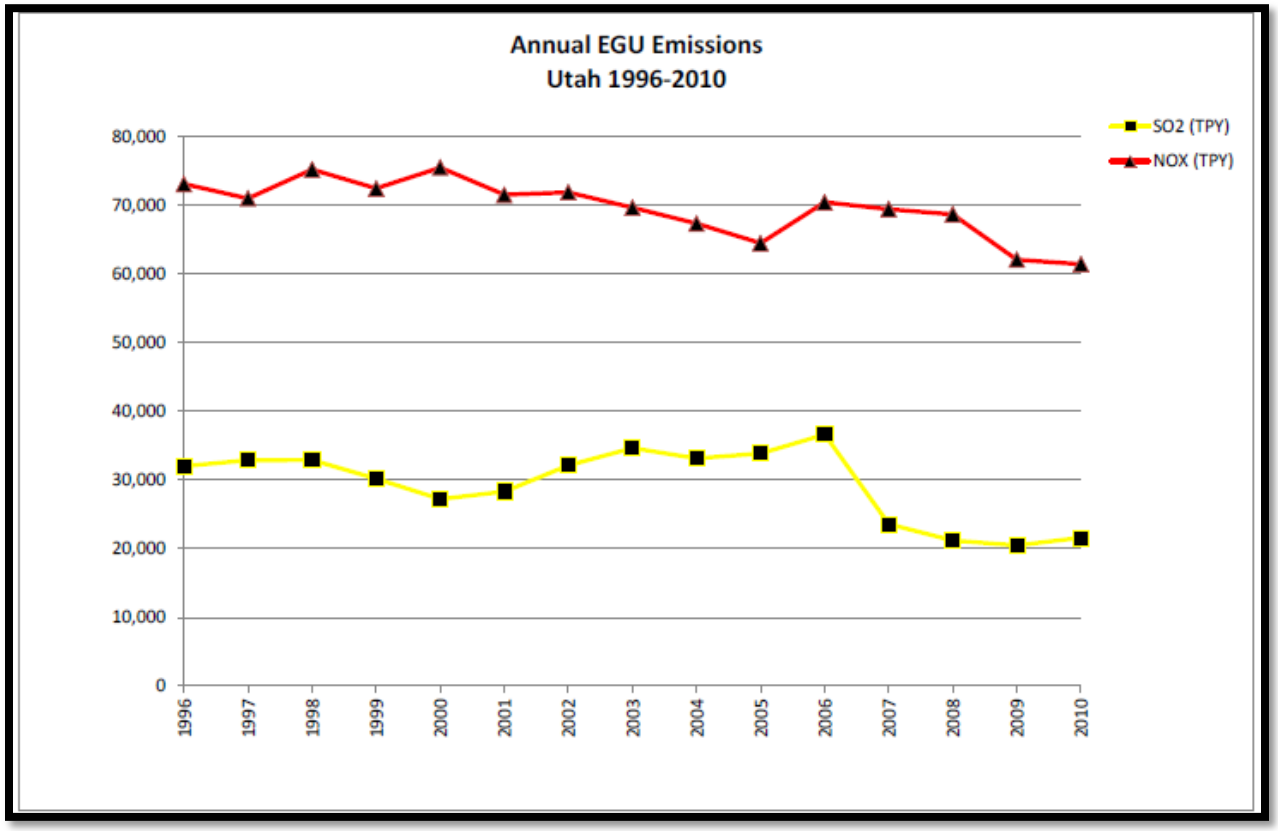

Figure 3.19. Sum of EGU Emissions of SO_2 and NOx Reported between 1996 and 2010

3.6 Changes to Anthropogenic Emissions: § 51.309(d)(10)(i)(E)

40 CFR §51.309(d)(10)(i)(E) requires *an assessment of any significant changes in anthropogenic emissions within or outside the State that have occurred over the past 5 years that have limited or impeded progress in reducing pollutant emissions and improving visibility."*

Table 3.15 displays the average light extinction for the 20% worst days over the 5-year period 2005 through 2009 for all Class I areas in Utah. The table demonstrates that on the 20% worst days in the Class I areas in Utah, particulate organic mass and ammonium sulfate are the major concern for visibility impairment. Appendix M includes monitoring data summaries over the 5-year period 2005-2009 for the 20% worst and best days for each Class I area in Utah.

Table 3.15. Average extinction for 20% Worst Days for the Current Progress Period of 2005-2009

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
BRCA1	11.9	19% (2)	9% (5)	**45% (1)**	10% (4)	5% (6)	12% (3)	0% (7)
CANY1	11.0	23% (2)	14% (4)	**27% (1)**	7% (5)	7% (6)	20% (3)	0% (7)
CAPI1	11.3	24% (2)	12% (4)	**32% (1)**	8% (5)	7% (6)	17% (3)	0% (7)
ZICA1	12.3	21% (3)	7% (5)	**33% (1)**	9% (4)	7% (6)	22% (2)	0% (7)

The primary sources of anthropogenic particulate organic mass in Utah include prescribed burning, vehicle exhaust, vehicle refueling, solvent evaporation (e.g., paints), food cooking, and various commercial and industrial sources. Anthropogenic sources of SO_2 include coal-burning power plants and other industrial sources, such as boilers, oil refineries and copper smelters. Stationary point sources account for approximately 90% of SO_2 emissions in Utah.

There do not appear to be any anthropogenic emissions within Utah that would have limited or impeded progress in reducing pollutant emissions or improving visibility.

3.7 Assessment of Current SIP Strategy: § 51.309(d)(10)(i)(F)

40 CFR § 51.309(d)(10)(i)(F) requires "an assessment of whether the current implementation plan elements and strategies are sufficient to enable the State, or other States with mandatory Federal Class I areas affected by emissions from the State, to meet all established reasonable progress goals."

Figure 3.20 shows the annual and 5-year period averages for the 20% worst days at Canyonlands National Park and Arches National Park from 2000 to 2010. This figure demonstrates that on the 20% worst days, visibility continues to improve at these Class I areas from the baseline average through the first progress period. Similar results are seen for Zion National Park at the ZICA1 monitor (Appendix M). Figures 3.21 and 3.22 show the annual and 5-year period averages for the 20% worst days at Bryce Canyon

National Park (BRCA1 site) and Capitol Reef Nation Park (CANY1 Site). At both of these monitors, the 5-year period average from 2005 to 2009 is higher than the baseline. Note that the increase in deciviews in 2009 from these monitors is attributed to peak increases of particulate organic mass, which was a result of large fire events throughout the region in both July and August of that year. Utah should not be held accountable for visibility impairing emissions that are uncontrollable. However, even with wildfire emissions included in the assessment, monitoring data shows that visibility continues to improve for both the 20% best and worst days in 2010 at all IMPROVE sites (Appendix M).

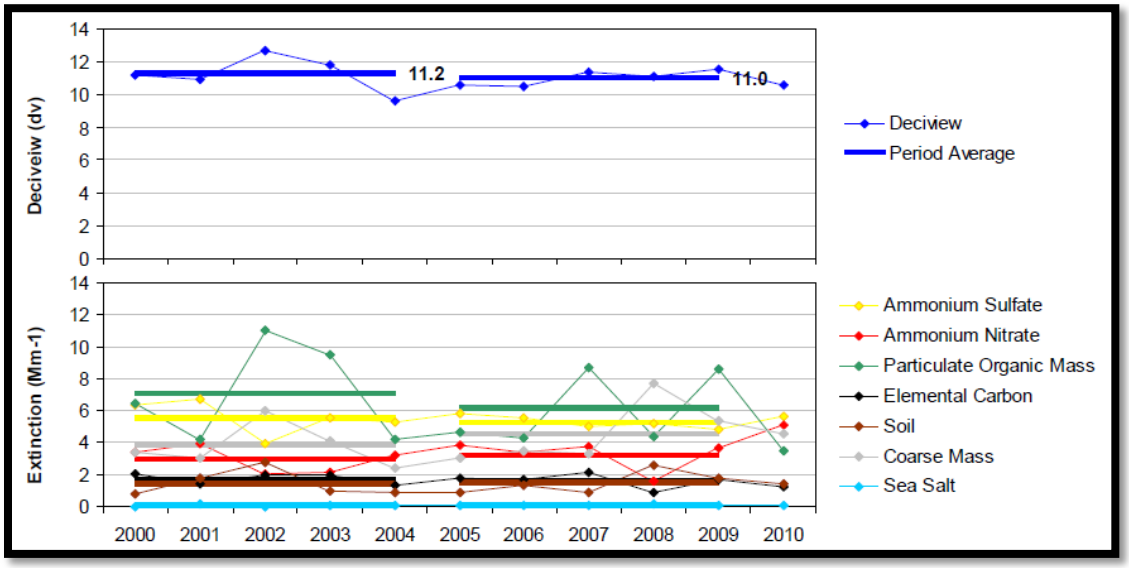

Figure 3.20. Annual and 5-Year Period Averages for the 20% Worst Days at Canyonlands and Arches National Parks (CANY1 IMPROVE Site)

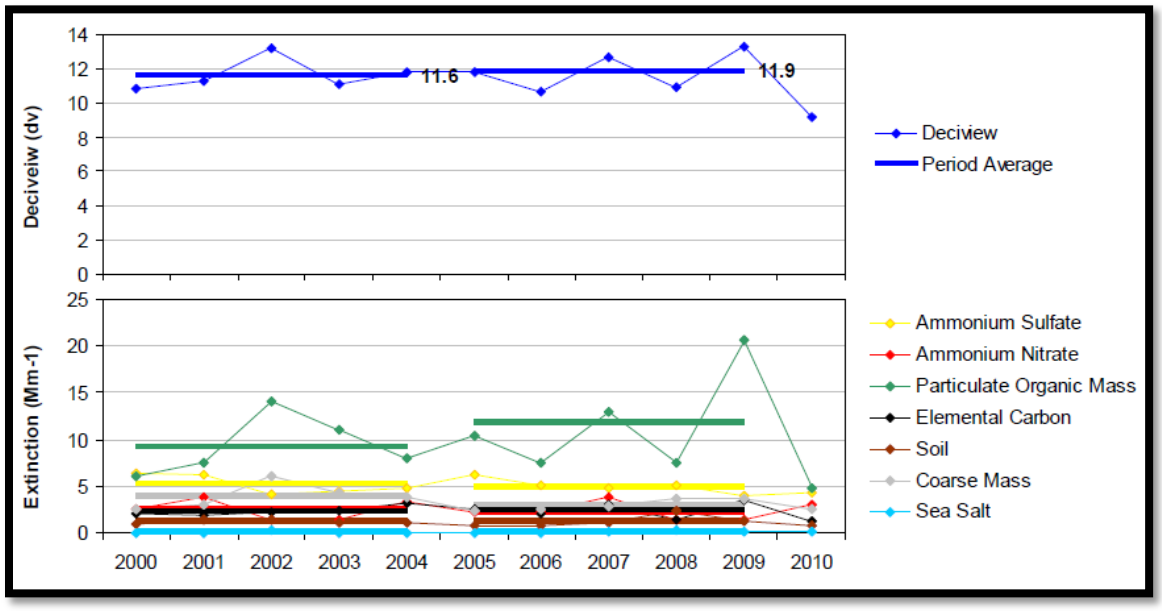

Figure 3.21. Annual and 5-Year Period Averages for the 20% Worst Days at Bryce Canyon National Park (BRCA1 IMPROVE Site)

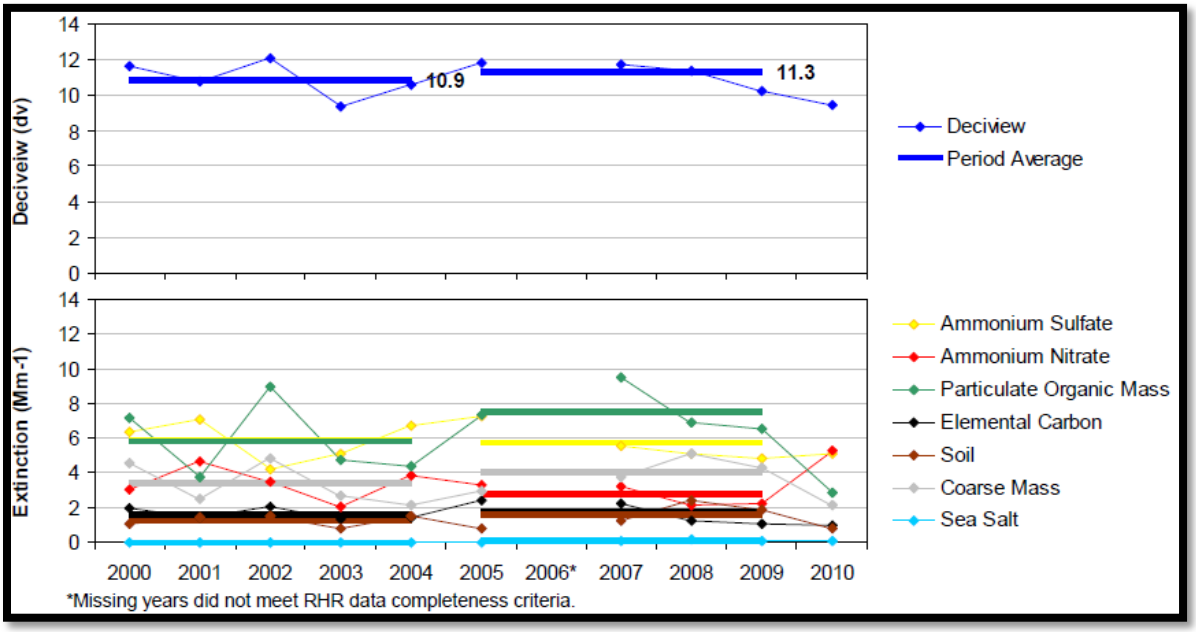

Figure 3.22. Annual and 5-Year Period Averages for the 20% Worst Days at Capitol Reef (CAPI1 IMPROVE Site)

As table 3.16 shows, Utah is showing improvement in visibility on the most impaired days and no degradation on the least impaired days between baseline and current monitoring data. The first 5-year progress period evaluated in this report covers the 2005-2009 timeframe, as it represents the most recent successive 5-year averaging period; however, the WRAP TSS has been updated to include data up through 2012. The average of the first three years of the next successive 5-year progress period (2010-2014) indicates that visibility at Utah's Class I areas is improving on both the 20% worst and 20% best days, and is in fact on course to exceed emissions reductions used by WRAP in its preliminary reasonable progress (PRP) projections for 2018 (Table 3.16).

Table 3.16. Utah Class I Area IMPROVE Sites Visibility conditions – 20% Most and Least Impaired Days Including 2010 to 2012 data

Class I Area	Baseline (2000-2004) (dv)	Current (2005-2009) (dv)	(2010-2012) (dv)	2018 Preliminary Reasonable Progress Case (PRP18a) (dv)
20% Worst Days				
Arches NP (CANY1)	11.2	11.0	10.6	10.9
Bryce Canyon NP (BRCA1)	11.6	11.9	10.0	11.2
Canyonlands NP (CANY1)	11.2	11.0	10.6	10.9
Capitol Reef NP (CAPI1)	10.9	11.3	10.1	10.5
Zion NP (ZICA1)	12.5	12.3	*10.8*[8]	N/A[9]
20% Best Days				
Arches NP (CANY1)	3.7	2.8	2.8	3.5
Bryce Canyon NP (BRCA1)	2.8	2.1	1.7	2.6
Canyonlands NP (CANY1)	3.7	2.8	2.8	3.5
Capitol Reef NP (CAPI1)	4.1	2.7	2.4	3.9
Zion NP (ZICA1)	5.0	4.3	4.4 (see footnote 7)	N/A (see footnote 7)

Utah believes that the current control strategies in the state's Regional Haze SIP are sufficient to improve visibility at Federal Class I areas in the state and to benefit all Class I areas outside of Utah that might be impacted by emissions from Utah.

Northern Utah, which may impact Federal Class I areas in Idaho, Nevada, and Wyoming, is an urban area with emissions predominately coming from mobile sources. Mobile NO_x emissions in the four main urban counties (Weber, Salt Lake, and Utah) are projected to decrease 42,000 tons/yr or 61% between 2002 and 2018.

BART controls installed to plants in central Utah (as described in Section 3.2 of this report) are projected to decrease SO_2 emissions by 13,200 and NO_x emissions by 6,200 tons between 2002 and 2018. And as is the case with northern Utah, southern Utah has an emissions inventory dominated by mobile sources. In Washington County, NO_x emissions from mobile sources are projected to decrease 2,300 tons or 57% between 2002 and 2018. These emissions reductions benefit Federal Class I areas in Colorado, New Mexico and Arizona.

[8] Includes 2012 data only; there were no results available for 2010 and 2011.

[9] There is no PRP18a established for the new ZICA1 monitor. The PRP18a was originally established for the original ZIONI IMPROVE monitor, which was discontinued on July 29, 2004.

As stated in Section K of the SIP, oil and gas emissions in eastern Utah are increasing. Approximately 90% of current emissions from oil and gas development in Uintah and Duchesne Counties occur on land that is under the jurisdiction of the Ute Indian Tribe and EPA and is therefore not covered under Utah's SIP. For the areas under state jurisdiction, the WRAP Phase III inventory estimated that NOx emissions from oil and gas production would increase by about 1,000 tons/yr between 2006 and 2012. Figure 19 in Utah's SIP shows the expected impact from Utah sources on Class I areas in western Colorado. While NOx emissions from oil and gas production are increasing, mobile source NOx emissions are decreasing in the urban area along the Wasatch Front, and NOx emissions are decreasing due to BART in Central Utah, showing an overall decreased contribution to nitrate levels in western Colorado. In addition, new federal engine standards (NSPS IIII and JJJJ, NESHAP ZZZZ) are leading to additional reductions in NOx emissions that will be reflected in future inventories.

3.8 Assessment of Current Monitoring Strategy: § 51.309(d)(10)(i)(G)

40 CFR § 51.309(d)(10)(i)(G) requires "*a review of the State's visibility monitoring strategy and any modifications to the strategy as necessary.*"

The primary monitoring network for regional haze, both nationwide and in Utah, is the IMPROVE monitoring network. Given that IMPROVE monitoring data from 2000 to 2004 serves as the baseline for the regional haze program, the future regional haze monitoring strategy must necessarily be based on, or directly comparable to the current IMPROVE network. The IMPROVE measurements provide the only long-term record available for tracking visibility improvement or degradation; therefore, Utah intends to continue reliance on the IMPROVE network for complying with the RH monitoring requirement in the RH rule.

There are currently four IMPROVE sites in Utah (Table 3.17), and no modifications to the existing visibility monitoring strategy are necessary at this time.

Table 3.17. Utah CIAs and Representative IMPROVE Monitors

Class I Area	Representative IMPROVE Site	Latitude	Longitude	Elevation (m)
Bryce Canyon NP	BRCA1	37.62	-112.17	2481
Canyonlands NP	CANY1	38.46	-109.82	1798
Arches NP				
Capitol Reef NP	CAPI1	38.30	-111.29	1896
Zion NP	ZICA1*	37.20	-113.15	1215

*Replaced the ZION1 monitoring site in 2003.

3.9 Determination of Adequacy: § 51.309(d)(10)(ii)

40 CFR § 51.309(d)(10)(ii)(d)(10)(ii) requires "*Determination of the adequacy of existing implementation plan. At the same time the State is required to submit any 5-year progress report to EPA in accordance with paragraph (d)(10)(i) of this section, the State must also take one of the following actions based upon the information presented in the progress report:*

(1) If the State determines that the existing implementation plan requires no further substantive revision at this time in order to achieve established goals for visibility improvement and emissions reductions, the State must provide to the administrator a negative declaration that further revision of the existing implementation plan is not needed at this time.

(2) If the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another State(s) which participated in a regional planning process, the State must provide notification to the administrator and to the other State(s) which participated in the regional planning process with the States. The State must also collaborate with the other State(s) through the regional planning process for the purpose of developing additional strategies to address the plan's deficiencies.

(3) Where the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources in another country, the State shall provide notification, along with available information, to the Administrator.

(4) Where the State determines that the implementation plan is or may be inadequate to ensure reasonable progress due to emissions from sources within the State, the State shall revise its implementation plan to address the plan's deficiencies within one year."

The State of Utah has provided the information required under 40 CFR § 51.309(d)(10)(ii)(d)(10)(i) and (d)(10(ii) in this 5-year progress report. Based on the information in this report, while the State of Utah has determined that the current implementation plan elements and strategies are sufficient to meet all established reasonable progress goals established by WRAP, the State acknowledges that EPA's disapproval of the BART determination for NOx and PM (because they did not comply with EPA's requirements pertaining to the factors that need to be considered as part of a BART determination) and that the State's determinations are in need of revision. The State of Utah is developing the 5-factor BART analysis and adding provisions to make the BART limits practically enforceable to address EPA's final action. The BART analysis and SIP provisions are being developed and submitted concurrently with this progress report.

4.0 REGIONAL SUMMARY FOR 309 GCVTC CLASS I AREAS

Section 309 rules were based on recommendations from the Grand Canyon Visibility Transport Commission (GCVTC) Recommendations report,[10] specific to visibility impacts at the 16 Class I areas on the Colorado Plateau. Of the nine western states originally eligible for Section 309 RH rule implementation, only the states of New Mexico, Utah, and Wyoming and the city of Albuquerque/Bernalillo County currently exercise this option.

The 16 Class I areas on the Colorado Plateau are depicted in Figure 4.1 and listed in Table 4.1. Note that the ZION1 site, which originally represented Zion Canyon National Park, has since been replaced with the ZICA1 site. This section presents regional progress summaries specific to monitoring and emissions data at these Colorado Plateau sites.

[10] The Grand Canyon Visibility Transport Commission Recommendations for Improving Western Vistas Report is archived on the WRAP website at www.wrapair.org/WRAP/reports/GCVTCFinal.PDF.

Table 4.1
Colorado Plateau Class I Areas and Representative IMPROVE Monitors

Class I Area	Representative IMPROVE Site	Latitude	Longitude	Elevation (m)
Arizona				
Grand Canyon NP	GRCA2	35.97	-111.98	2267
Mount Baldy WA	BALD1	34.06	-109.44	2508
Petrified Forest NP	PEFO1	35.08	-109.77	1766
Sycamore Canyon WA	SYCA1	35.14	-111.97	2046
Colorado				
Black Canyon of the Gunnison NP Weminuche WA	WEMI1	37.66	-107.80	2750
Flat Tops WA Maroon Bells-Snowmass WA West Elk WA	WHRI1	39.15	-106.82	3413
Mesa Verde NP	MEVE1	37.20	-108.49	2172
New Mexico				
San Pedro Parks WA	SAPE1	36.01	-106.84	2935
Utah				
Bryce Canyon NP	BRCA1	37.62	-112.17	2481
Canyonlands NP Arches NP	CANY1	38.46	-109.82	1798
Capitol Reef NP	CAPI1	38.30	-111.29	1896
Zion NP	ZICA1*	37.20	-113.15	1215

*Replaced the ZION1 monitoring site in 2003.

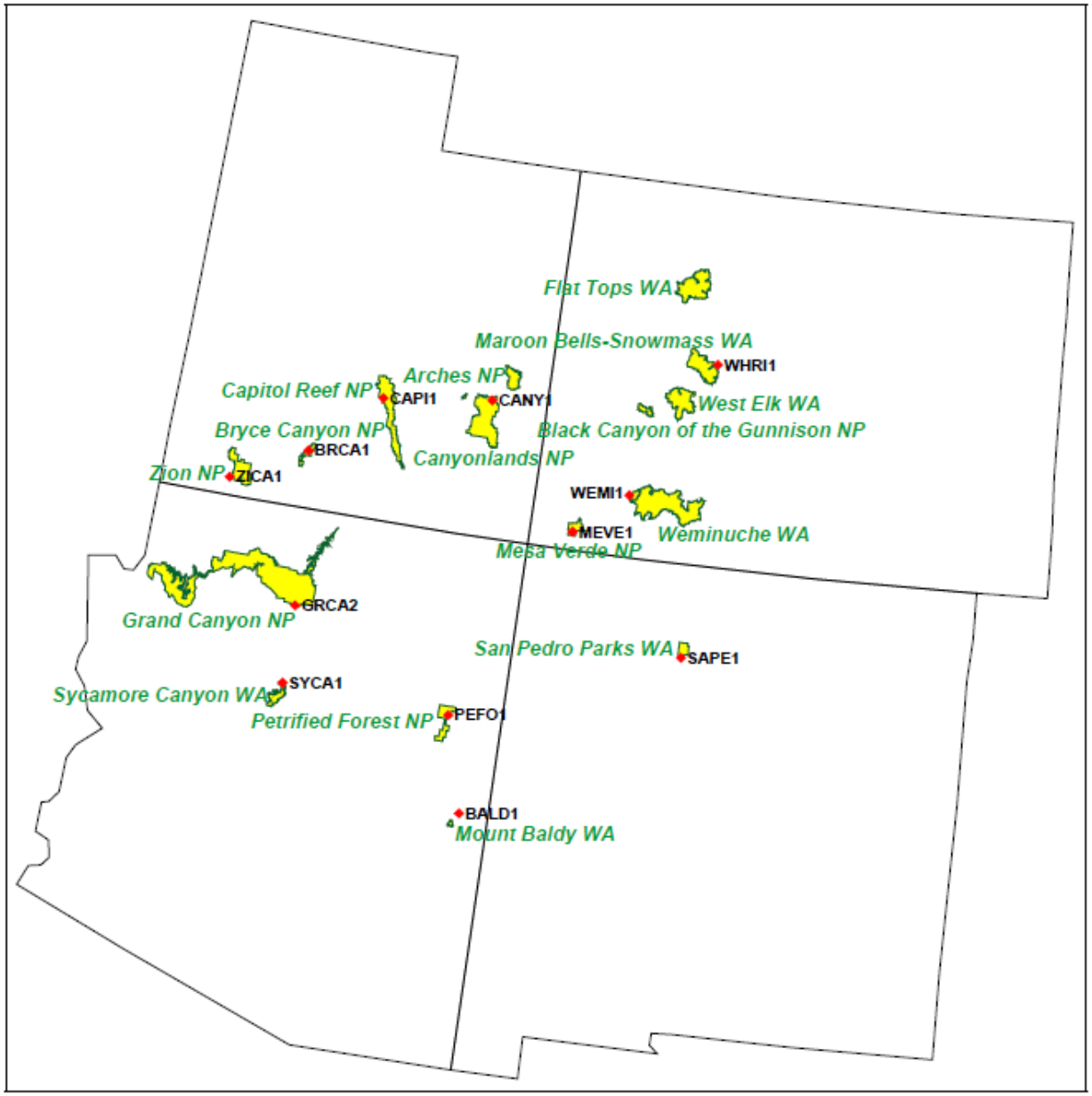

Figure 4.1. Map Depicting Colorado Plateau Class I Areas and Representative IMPROVE Monitors in Arizona, Colorado, New Mexico and Utah

Monitoring Data

Figures 4.2 and 4.3 present the 2005-2009 visibility averages for the 20% worst and best days for the IMPROVE sites representing Class I areas on the Colorado Plateau. The size of the pie chart is relative to the magnitude of visibility impairment, and colors represent the relative contribution of the pollutants which are measured by the IMPROVE network. Tables 4.2 and 4.3 present the difference between the 2000-2004 baseline period average and the 2005-2009 first progress period average for the 20% worst and best days, respectively, for the Class I area sites in the Colorado Plateau region.

Table 4.4 presents the differences between the 2000-2004 baseline period average extinction and the 2005-2009 progress period average for each Class I area site in the Colorado Plateau region for the 20% most impaired days, and Table 4.5 presents similar data for the least impaired days. Averages that increased are depicted in red text and averages that decreased in blue.

Trend statistics for the years 2000-2009 for each species at each Class I area site in the Colorado Plateau region are presented in Table 4.6. Only trends for aerosol species trends with p-value statistics less than 0.15 (85% confidence level) are presented in the table here, with increasing slopes in red and decreasing slopes in blue.

Some general observations for the current visibility conditions and the difference between current and baseline conditions are listed below:

- The largest contributors to aerosol extinction at the Colorado Plateau sites were particulate organic mass, ammonium sulfate, and coarse mass.

- For all sites, the 5-year average as measured in deciview metric decreased for the best days between the baseline and first progress period.

- For most sites, the 5-year average as measured in deciview metric decreased for the worst days between the baseline and first progress period. Exceptions included GRCA2 and BALD1 in Arizona and BRCA1 and CAPI1 in Utah. Some contributing factors for aerosol measurements that affected increased in 5-year average deciviews are listed below.

- The increase at GRCA2 was due to increases in ammonium sulfate, elemental carbon, particulate organic mass and soil, partially offset by decreases in ammonium nitrate and coarse mass. The particulate organic carbon increase was associated with high measurements due to fire events in June and August of 2009. No statistically significant increasing annual trends were measured for any of the species at the GRCA2 site.

- Extinction remained relatively unchanged in terms of deciviews for the worst days measured at the BALD1 site. Increases in coarse mass, soil, and ammonium sulfate were offset by decreases in particulate organic mass, elemental carbon, and ammonium nitrate. Trend statistics showed an increasing coarse mass trend at the BALD1 and PEFO1 sites in eastern Arizona.

- At the BRCA1 and CAPI1 sites, the largest contributor to increases was particulate organic mass which, similar to GRCA2, was associated with large fires events in July and August 2009. These increases were offset by decreases in ammonium nitrate and ammonium sulfate. An increasing soil trend was measured for the worst days at the CAPI1 site.

- Increases in 5-year average ammonium sulfate were measured at many regional sites, although most sites showed decreasing annual average ammonium sulfate trends. The 5-year average was influenced by relatively high regional measurements of ammonium sulfate in 2005. Figure 5.1.3 presents a plot of the annual averages for all Colorado Plateau sites, showing the high values measured in 2005, followed by generally decreasing trends.

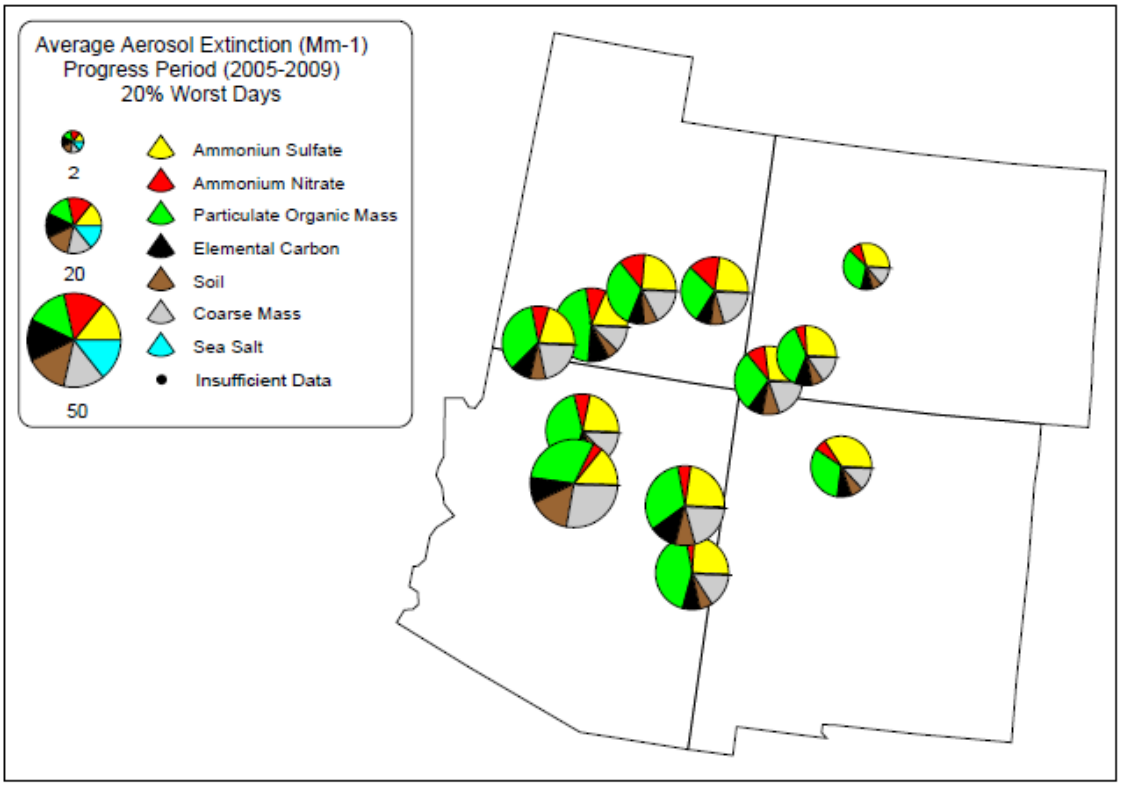

Figure 4.2. Regional Average of Aerosol Extinction by Pollutant for the First Progress Period Average (2005-2009) for 20% worst days

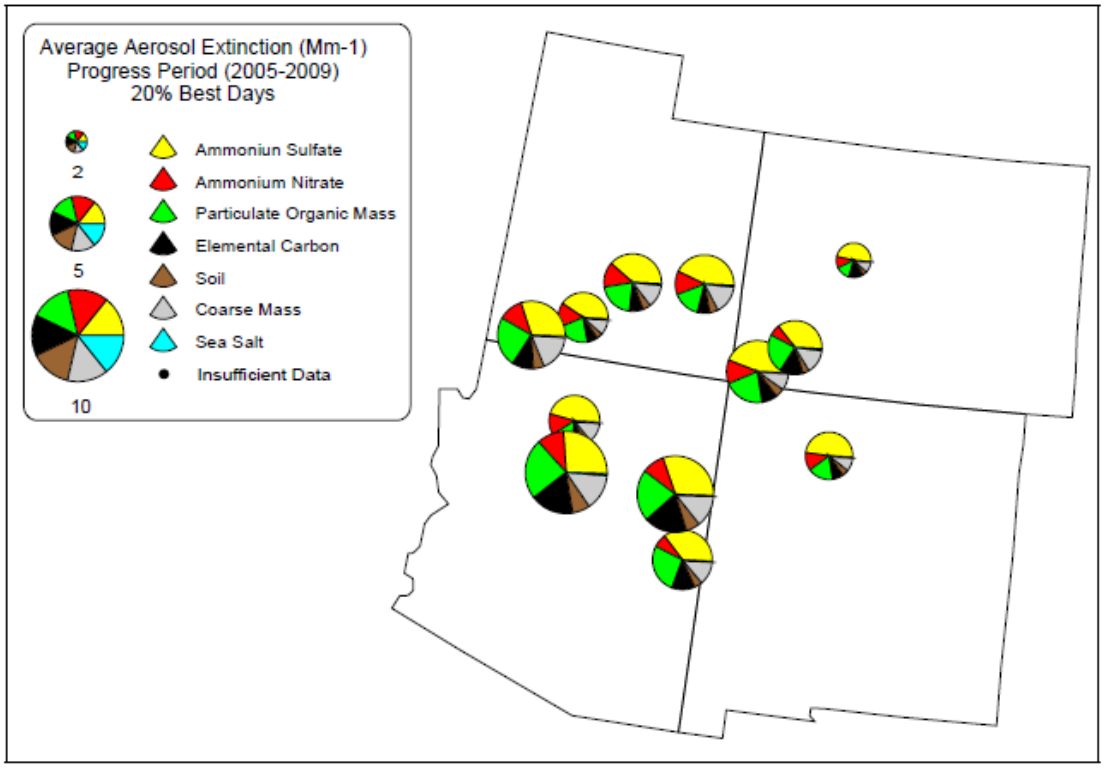

Figure 4.3. Regional Average of aerosol Extinction by Pollutant for First Progress Period Average (2005-2009) for 20% Best Days

Table 4.2
Colorado Plateau Class I Area IMPROVE Sites
Current Visibility Conditions
2005-2009 Progress Period, 20% Most Impaired Days

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
Arizona								
GRCA2	12.0	22% (2)	7% (5)	**41% (1)**	11% (4)	6% (6)	12% (3)	0% (7)
BALD1	11.8	25% (2)	4% (6)	**42% (1)**	8% (4)	6% (5)	16% (3)	0% (7)
PEFO1	13.0	23% (2)	5% (6)	**31% (1)**	11% (4)	8% (5)	21% (3)	1% (7)
SYCA1	15.2	15% (4)	4% (6)	**29% (1)**	9% (5)	15% (3)	28% (2)	0% (7)
Colorado								
WEMI1	10.0	27% (2)	5% (6)	**36% (1)**	10% (4)	7% (5)	15% (3)	0% (7)
WHRI1	8.9	30% (2)	8% (5)	**33% (1)**	8% (4)	7% (6)	13% (3)	0% (7)
MEVE1	11.3	27% (2)	9% (4)	**28% (1)**	7% (6)	9% (5)	20% (3)	0% (7)
New Mexico								
SAPE1	9.9	**34% (1)**	6% (6)	32% (2)	8% (4)	7% (5)	13% (3)	0% (7)
Utah								
BRCA1	11.9	19% (2)	9% (5)	**45% (1)**	10% (4)	5% (6)	12% (3)	0% (7)
CANY1	11.0	23% (2)	14% (4)	**27% (1)**	7% (5)	7% (6)	20% (3)	0% (7)
CAPI1	11.3	24% (2)	12% (4)	**32% (1)**	8% (5)	7% (6)	17% (3)	0% (7)
ZICA1	12.3	21% (3)	7% (5)	**33% (1)**	9% (4)	7% (6)	22% (2)	0% (7)

*Highest aerosol species contribution per site is highlighted in bold.

Table 4.3
Colorado Plateau Class I Area IMPROVE Sites
Current Visibility Conditions
2005-2009 Progress Period, 20% Least Impaired Days

Site	Deciviews (dv)	Percent Contribution to Aerosol Extinction by Species (Excludes Rayleigh) (% of Mm^{-1}) and Rank*						
		Ammonium Sulfate	Ammonium Nitrate	Particulate Organic Mass	Elemental Carbon	Soil	Coarse Mass	Sea Salt
Arizona								
GRCA2	2.2	**45% (1)**	13% (4)	15% (2)	9% (5)	4% (6)	14% (3)	1% (7)
BALD1	2.9	**35% (1)**	7% (5)	26% (2)	13% (4)	5% (6)	13% (3)	1% (7)
PEFO1	4.6	**31% (1)**	9% (5)	21% (2)	19% (3)	6% (6)	14% (4)	0% (7)
SYCA1	5.1	**27% (1)**	10% (5)	23% (2)	17% (3)	7% (6)	15% (4)	1% (7)
Colorado								
WEMI1	2.4	**36% (1)**	6% (5)	23% (2)	15% (4)	4% (6)	15% (3)	1% (7)
WHRI1	0.2	**46% (1)**	10% (5)	14% (3)	15% (2)	5% (6)	11% (4)	0% (7)
MEVE1	3.1	**44% (1)**	12% (3)	21% (2)	9% (5)	5% (6)	9% (4)	0% (7)
New Mexico								
SAPE1	1.0	**47% (1)**	12% (3)	18% (2)	8% (5)	5% (6)	10% (4)	1% (7)
Utah								
BRCA1	11.9	19% (2)	9% (5)	**45% (1)**	10% (4)	5% (6)	12% (3)	0% (7)
CANY1	11.0	23% (2)	14% (4)	**27% (1)**	7% (5)	7% (6)	20% (3)	0% (7)
CAPI1	11.3	24% (2)	12% (4)	**32% (1)**	8% (5)	7% (6)	17% (3)	0% (7)
ZICA1	12.3	21% (3)	7% (5)	**33% (1)**	9% (4)	7% (6)	22% (2)	0% (7)

*Highest aerosol species contribution per site is highlighted in bold.

Table 4.4
Colorado Plateau Class I Area IMPROVE Sites
Difference in Aerosol Extinction by Species
2000-2004 Baseline Period to 2005-2009 Progress Period
20% Most Impaired Days

Site	Deciview (dv)			Change in Extinction by Species (Mm^{-1})*						
	2000-04 Baseline Period	2005-09 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
Arizona										
GRCA2	11.7	12.0	+0.3	+0.5	-0.4	+0.1	+0.5	+0.1	-0.3	0.0
BALD1	11.8	11.8	0.0	+0.3	-0.1	-2.1	-0.7	+0.4	+1.3	+0.1
PEFO1	13.2	13.0	-0.2	+0.5	-0.3	-1.4	+0.5	+0.6	-1.0	+0.1
SYCA1	15.3	15.2	-0.1	+0.7	-0.7	-0.5	+0.4	-1.0	+1.4	0.0
Colorado										
WEMI1	10.3	10.0	-0.3	+0.1	-0.2	-1.4	-0.2	+0.1	0.0	-0.1
WHRI1	9.6	8.9	-0.7	+0.3	0.0	-2.3	-0.3	+0.1	-0.5	0.0
MEVE1	13.0	11.3	-1.7	-0.2	-0.3	-5.8	-0.7	-0.5	-2.0	0.0
New Mexico										
SAPE1	10.2	9.9	-0.3	+1.0	-0.4	-1.4	-0.1	-0.1	-0.2	0.0
Utah										
BRCA1	11.6	11.9	+0.3	-0.2	-0.3	+2.5	+0.2	+0.1	-0.9	0.0
CANY1	11.2	11.0	-0.2	-0.3	+0.3	-0.9	-0.1	+0.1	+0.8	0.0
CAPI1	10.9	11.3	+0.4	-0.2	-0.7	+1.8	+0.2	+0.3	+0.7	+0.1
ZICA1	12.5	12.3	-0.2	+0.2	-0.3	-0.8	-0.1	+0.1	0.0	+0.1

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction and values in blue indicate decreases.

Table 4.5
Colorado Plateau Class I Area IMPROVE Sites
Difference in Aerosol Extinction by Species
2000-20004 Baseline Period to 2005-2009 Progress Period
20% Least Impaired Days

Site	Deciview (dv)			Change in Extinction by Species (Mm^{-1})*						
	2000-04 Baseline Period	2005-09 Progress Period	Change in dv*	Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
Arizona										
GRCA2	2.2	2.2	0.0	+0.1	0.0	-0.1	0.0	0.0	0.0	0.0
BALD1	3.0	2.9	-0.1	-0.1	-0.1	-0.1	0.0	0.0	+0.1	0.0
PEFO1	5.0	4.6	-0.4	-0.1	-0.2	-0.4	0.0	+0.1	0.0	0.0
SYCA1	5.6	5.1	-0.5	+0.1	-0.1	-0.6	-0.2	-0.1	+0.1	0.0
Colorado										
WEMI1	3.1	2.4	-0.7	-0.1	-0.1	-0.4	-0.2	0.0	-0.1	0.0
WHRI1	0.7	0.2	-0.5	0.0	-0.1	-0.3	-0.1	0.0	0.0	0.0
MEVE1	4.3	3.1	-1.2	-0.3	-0.3	-0.5	-0.2	-0.2	-0.3	0.0
New Mexico										
SAPE1	1.5	1.0	-0.5	-0.1	-0.1	-0.2	-0.1	0.0	0.0	0.0
Utah										
BRCA1	2.8	2.1	-0.7	-0.1	-0.2	-0.3	-0.2	0.0	-0.1	0.0
CANY1	3.7	2.8	-0.9	-0.3	-0.1	-0.5	-0.1	-0.1	-0.2	0.0
CAPI1	4.1	2.7	-1.4	-0.3	-0.4	-0.5	-0.2	-0.1	-0.4	0.0
ZICA1	5.0	4.3	-0.7	-0.1	-0.2	-0.5	-0.2	0.0	-0.1	0.0

*Change is calculated as progress period average minus baseline period average. Values in red indicate increases in extinction and values in blue indicate decreases.

Table 4.6
Colorado Plateau Class I Area IMPROVE Sites
Change in Aerosol Extinction by Species
2000-2009 Annual Average Trends

Site	Group	Annual Trend* (Mm^{-1}/year)						
		Amm. Sulfate	Amm. Nitrate	POM	EC	Soil	CM	Sea Salt
Arizona								
GRCA2	20% Best	--	--	--	0.0	--	--	0.0
	20% Worst	--	-0.1	--	--	--	--	--
	All Days	--	0.0	--	--	--	--	--
BALD1	20% Best	--	0.0	--	0.0	--	0.0	0.0
	20% Worst	-0.2	--	--	--	0.1	0.3	0.0
	All Days	-0.1	0.0	--	--	--	0.1	0.0
PEFO1	20% Best	--	0.0	-0.1	--	--	--	0.0
	20% Worst	--	--	--	--	0.1	--	0.0
	All Days	--	0.0	--	--	0.0	0.1	0.0
SYCA1	20% Best	--	--	-0.1	--	--	--	0.0
	20% Worst	--	--	--	0.1	-0.3	--	--
	All Days	--	0.0	--	--	-0.1	--	--
Colorado								
WEMI1	20% Best	-0.1	0.0	-0.1	-0.1	--	--	--
	20% Worst	--	--	--	0.0	--	--	--
	All Days	--	0.0	--	-0.1	--	--	--
WHRI1	20% Best	--	0.0	-0.1	0.0	--	--	--
	20% Worst	--	--	--	-0.1	--	--	0.0
	All Days	--	--	-0.1	0.0	--	--	0.0
MEVE1	20% Best	-0.1	0.0	-0.1	0.0	0.0	0.0	--
	20% Worst	--	--	--	-0.2	--	--	0.0
	All Days	-0.1	--	-0.3	-0.1	--	--	0.0
New Mexico								
SAPE1	20% Best	--	0.0	0.0	0.0	--	--	--
	20% Worst	--	-0.1	--	--	--	--	--
	All Days	--	0.0	-0.1	0.0	--	0.0	0.0
Utah								
BRCA1	20% Best	--	0.0	-0.1	0.0	--	0.0	0.0
	20% Worst	-0.2	--	0.5	0.1	--	--	0.0
	All Days	-0.1	0.0	--	--	--	--	--
CANY1	20% Best	-0.1	--	-0.1	0.0	--	-0.1	0.0
	20% Worst	-0.1	--	--	--	--	--	0.0
	All Days	-0.1	0.0	--	0.0	0.0	--	0.0
CAPI1	20% Best	-0.1	-0.1	-0.1	0.0	--	-0.1	--
	20% Worst	--	-0.2	--	--	0.1	--	0.0
	All Days	-0.1	-0.1	--	0.0	--	--	0.0
ZICA1	20% Best	0.0	--	--	0.0	0.0	--	0.0
	20% Worst	-0.5	--	--	--	--	--	--
	All Days	-0.2	--	--	-0.1	0.1	--	--

*(--) Indicates statistically insignificant trend (<85% confidence level). Annual averages and complete trend statistics for all significance levels are included for each site in state specific appendices.

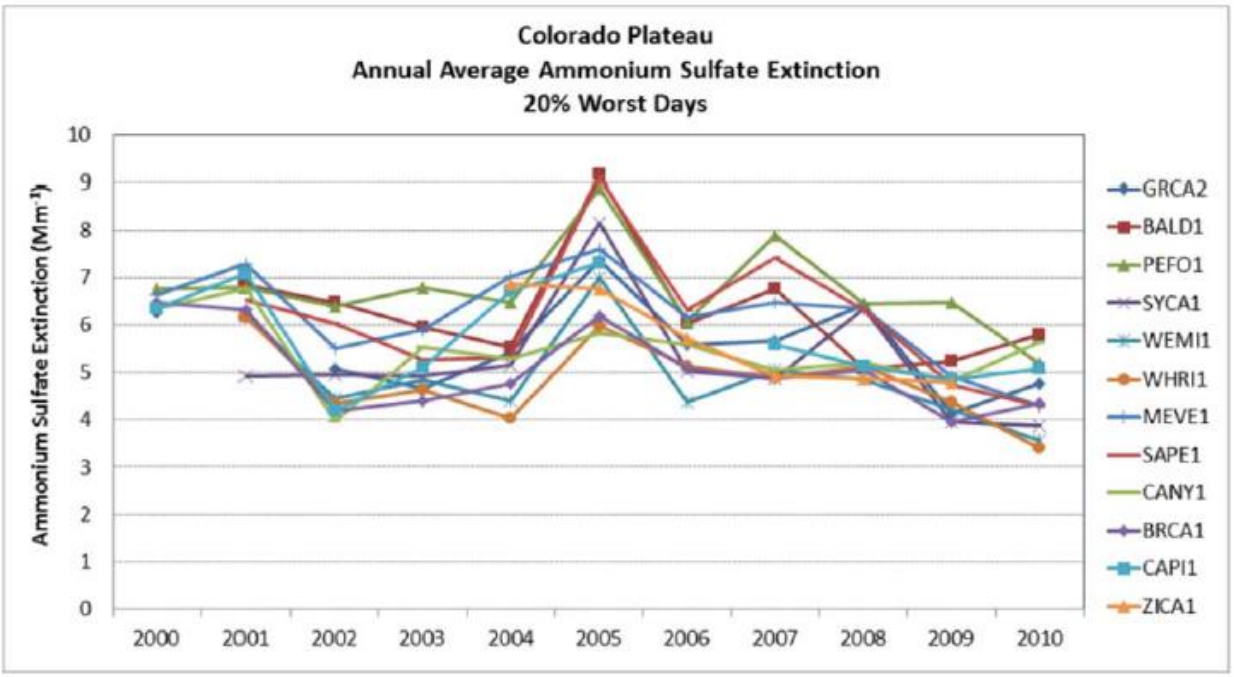

Figure 4.4 Chart Depicting Annual Average Ammonium Sulfate Concentrations for the 20% Worst Days as Measured at the Colorado Plateau CIA IMPROVE Sites

Similar to 308 requirements, Section 309 states are required to address how total state emissions have changed over the past five years (51.309(d)(10)(i)(D)). Emission inventory summaries using 2002 and 2008 inventories to represent changes between the baseline and progress periods are described in detail for the entire state in Section 3.5.

In addition to tracking these differences in inventories, for the initial SIPs, Section 309 states were required to identify "clean air corridors" and track emissions inside and outside of these corridors that may affect impairment on the cleanest days.[11] In these initial Section 309 SIPs, an area covering major portions of Nevada, southern Utah, eastern Oregon and southwestern Idaho was defined as a "clean air corridor," which was intended to represent a region from which clean air transport influences many of the clean air days at Grand Canyon National Park. Visibility has improved for the best days at all of the Class I area sites on the Colorado Plateau, so emissions specific to the "clean air corridor" counties are not presented separately here.

As part of the Western Backstop Sulfur Dioxide Trading Program, the participating states (and county) identified SO_2 emissions milestones, where a milestone is a maximum level of annual emissions for a given year. WRAP supports the Section 309 states with the submittal of annual regional SO_2 and emission milestone reports which compare actual emissions estimates to the pre-defined milestones.[12] Figure 4.5 presents a plot from the most recent SO_2 milestone report, showing the 3-year average of current emissions through 2012, which indicated that actual emissions were below the SO_2 milestone.

[11] Section 51.309(d)(3) states, for treatment of clean-air corridors, "the plan must describe and provide for implementation of comprehensive emission tracking strategies for clean-air corridors to ensure that the visibility does not degrade on the least-impaired days at any of the 16 Class I areas."

[12] Annual regional SO2 emissions and milestone reports are located on the WRAP website at http://www.wrapair2.org/reghaze.aspx.

Additionally, SO_2 emissions specific to EGU sources are presented in Figure 3.19 on an annual basis showing changes in these sources between 1996 and 2010 for Utah.

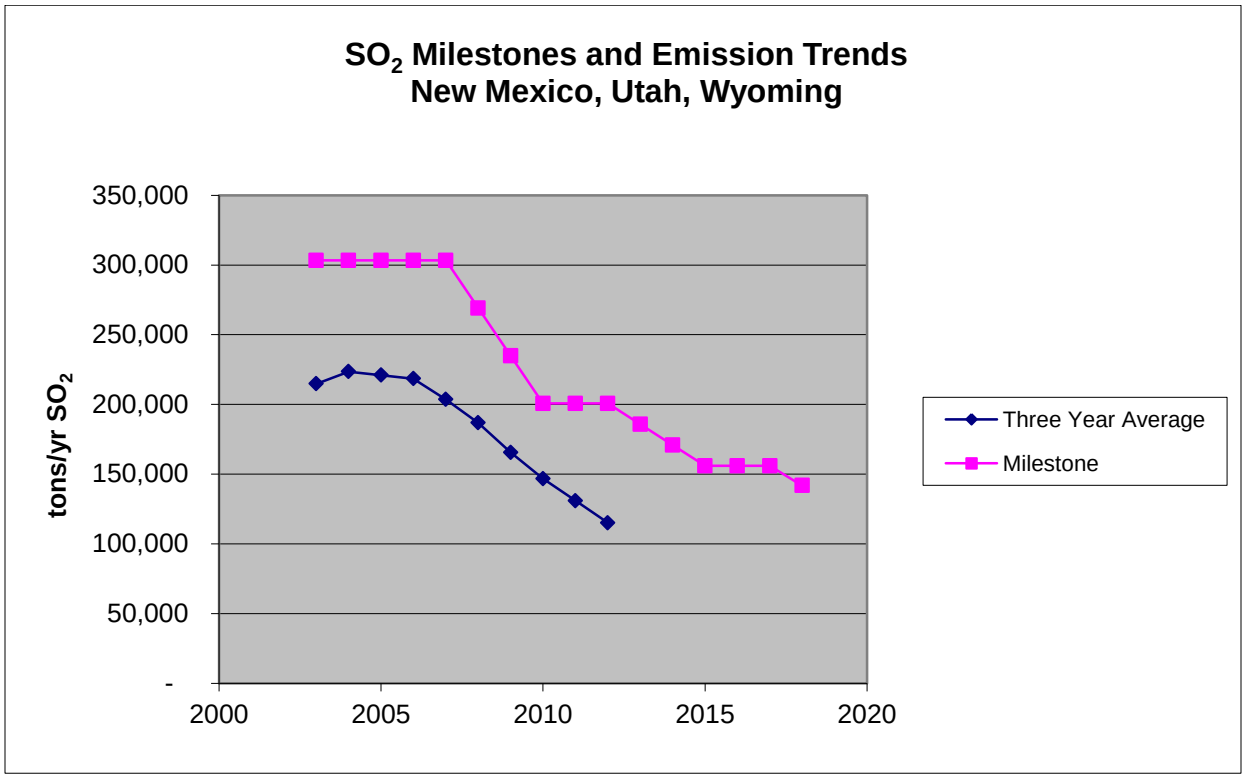

Figure 4.5. Chart Depicting 3-Year Average Sum of SO_2 Emissions for New Mexico, Utah and Wyoming and the City of Albuquerque/Bernalillo County as Compared to the Section 309 SIP SO_2 Milestones